Pit and Quarry

With which is consolidated CEMENT-MILL & QUARRY

Member Audit Bureau of Circulations

Read in Largest Number of Plants

Vol. XXIII November 4, 1931 No. 3

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Vol. XXIII CHICAGO, NOVEMBER 4, 1931 No. 3

I. C. C. Rate Decision Hits Most Producers

INCREASES UP TO $6 PER CAR

Practically all of the nonmetallic-minerals were included in the increases in freight rates ordered last month by the Interstate Commerce Commission, following the application of the railroads for a blanket rise of 15 per cent. in all rates. The blanket increase was denied but the new rates specifically allowed will increase the annual income of the railroads by an estimated $125,000,000.

The higher rates as affecting the nonmetallic-mineral industries are as follows:

Increase of $3 per car:
Sand (other than molding or glass)
Gravel
Stone (crushed, broken or ground)
Slag

Increase of $6 per car:
Phosphate rock (crude, ground or unground)
Sulphur
Stone (rough or dressed)
Asphalt (natural-rock or by-product)
Artificial stone

Increase of 1c. per 100 lb.
Cement (natural or Portland)
Lime
Brick (all common types, including sand-lime)

Gypsum, while not specifically mentioned, will come under the $3-per-car increase, it is believed, under "products of mines not specified."

U. S. Gypsum Co. Denied Trade-Mark Case Review

The Supreme Court has denied the U. S. Gypsum Co. a review of a recent lower court decision in company's dispute with the Plastoid Products, Inc., over the trade-mark "rocklath."

To Install Filters at Oklahoma Cement Plant

What is said to be the largest single installation of slurry filters in the cement industry will shortly be put into service at the plant of the Oklahoma Portland Cement Co. at Ada, Okla. The filters will have a total filtering area of 9,600 sq. ft. and will be composed of six units. They are now being manufactured by Oliver United Filters Inc., of San Francisco, Cal.

The Oklahoma installation follows closely upon the recent addition of similar equipment at the plant of the Arkansas Portland Cement Co. Both plants are under the ownership and management of the Ideal Cement Co. interests of Denver, Colo.

$1,000,000 Superhighway to Be Built in Delaware

The Delaware State Highway Commission plans to construct a $1,000,000 superhighway in that state to connect with a 40-ft. boulevard which has been proposed for construction from Washington, D. C., through Maryland to the Delaware line. No action has been taken by the Maryland Roads Commission looking to the construction of the boulevard through Maryland. The first section of the Delaware road is expected to be started this fall.

Universal Atlas Plant to Work Through Winter

No winter shut-down is contemplated at the Hudson, N. Y., plant of the Universal Atlas Cement Co., according to Superintendent Richard A. Dittmar. Reduced production schedules and shorter working hours have been put into effect in an attempt to provide steady work for all employees.

St. Paul Operator Opens Another Crushing Plant

The J. L. Shiely Co. of St. Paul, Minn., recently opened a new crushed-stone plant near Mendota, Minn. The plant will supplement the company's present unit near St. Paul and is being acquired in anticipation of a greater demand next year, J. L. Shiely, president, declares.

Takes 30-Year Lease on Western Asbestos Lands

The Pacific Coast Asbestos Mining Co., recently organized at Seattle, Wash., has taken a 30-year lease of the properties formerly operated by the Asbestos-Talc Products Co. near Burlington, Wash. The lease was drawn on a royalty basis and operations are scheduled to start shortly.

Two Producers Plan 24-Hour Schedules

NIGHT OPERATIONS ANNOUNCED

Despite slack business in general, the nonmetallic-mineral industries seem to be faring quite well, at least in some sections. Two plants, one in the south and the other in the middle west, recently announced that both day and night operation would be started in order to keep up with the demand.

The M. E. Gillioz Co. of Dockery, Mo., crushed-stone producer, has installed flood lights at its plant and quarry for 24-hour operation daily. The company is supplying stone for state-highway surfacing. The plant had been producing 300 cu. yd. during daylight hours and this is expected to be doubled when night operation gets under way. D. V. Smith is superintendent.

Road-building demands are also responsible for the decision of the Liberty Gravel Co. of Brookhaven, Miss., to operate at night. This plant is producing gravel and shipping by rail, cars being loaded by trucks which shuttle between the plant and the railway siding. Since night production began a few weeks ago, ten trucks have been in constant operation.

Harbor Line Abrogated; Producer Loses Deposit

With the abrogation by the government of the harbor line, established in 1898 on the Mississippi River at Davenport, Ia., for the purpose of erecting a sea wall, the Builders Sand & Gravel Co. will lose pit rights, under lease, amounting to two city lots and about half of the property on which gravel operations are conducted. Removal of the land will be paid for by the war department, however.

Michigan Gravel Plant Ends Season's Operation

The plant of the Jonesville Gravel Co. of Jonesville, Mich., has been closed for the season, according to Philip Penrod, manager. More than 1,200 car loads of sand and gravel were shipped during the spring and summer, somewhat smaller than normal due to slack demands.

Orders Winter Work to Help Employment

GREAT LAKES CEMENT CO. ACTS

The Great Lakes Portland Cement Corp. plant at Buffalo, N. Y., will be kept in operation all winter with its full staff of workers, according to an announcement from Adam L. Beck, president. The announcement followed a recent meeting of the board of directors at which full-time employment was decided upon as a means of relieving the unemployment situation. The directors expressed the belief that their action would take a considerable burden from welfare relief that would have been necessary had they curtailed their production to supply present demands.

"We feel that every business enterprise owes an obligation to its employees, to the community in which it carries on its business and to the country of which we are all citizens," said Mr. Beck.

"There are 650 men, women and children dependent upon the operation of the Great Lakes Portland Cement Co. plant for their housing, clothing and food during the winter months. The city, state and national relief organizations are already heavily burdened. We feel, therefore, that the best thing we can do to discharge our duty to our employees, our community and our country is to keep our men employed right through the winter.

"In taking care of our own people in this way, we feel that we are doing all within our power to relieve the serious situation facing us this winter, and we hope that other companies will see their way clear to take the same step.

"No depression can last forever. Much unemployment is, no doubt, due to a false feeling of insecurity on the part of some employers. If every organization would put its own house in order and look after its own people with faith in our country's future, much unemployment could be relieved, more confidence created, and new buyers brought into the market places of all industry."

Indiana Gravel Co. Head, Born a Slave, Is Dead

John Jones, 87, who was born a slave and who became a widely-known colored citizen of Indianapolis, Ind., and president of the John Jones & Son Gravel Co., died recently.

Jones for twenty-one years was a slave in the south and came to Indianapolis after the civil war. He obtained a horse and wagon and started the business which now bears his name. For sixty years he lived on a farm north of Indianapolis. In 1871 he organized the business of obtaining orders for sand and gravel from contractors in Indianapolis.

He built the business, obtaining the sand and gravel wherever he found a likely spot. At the time of his death his company was the owner of two gravel plants and a fleet of motor trucks.

Texas Gulf Sulphur Co. Acquires Huge Deposits

Sulphur rights on a large leased acreage in Jefferson County, Texas, which were owned by Gulf Production Co. (Gulf Oil), have been purchased by Texas Gulf Sulphur Co. The latter company has moved two drilling rigs to the new location and will drill a number of test wells. It was while drilling a test for oil that Gulf Production Co. penetrated a sulphur deposit the size of which will not be determined until the test wells are drilled. Texas Gulf Sulphur Co. has been active for some time past in making explorations in southeast Texas in search for new sulphur deposits.

Advance $105,875,000 in Federal Aid to States

Secretary of Agriculture Arthur M. Hyde has just apportioned to the states a total of $105,875,000 previously authorized for federal aid in road construction for the fiscal year ending June 30, 1933. The apportionment was made two months in advance of the usual date in order that the states might get an early start on plans for next season's construction, the department said.

In making the apportionment, 2½ per cent. of the total appropriation of $125,000,000 was deducted for administration. The remainder was then apportioned on the basis of area, population and mileage of rural post roads in the various states. From the share allotted to each state there was deducted one-fifth of the emergency advance funds apportioned last December.

Completes Installation of New Concrete Plant

The Cherokee Sand & Gravel Co. of Knoxville, Tenn., has completed the installation of a $45,000 ready-mixed-concrete plant at Knoxville and is now producing material for various building projects. R. P. Barton is in charge of the plant. Features of the operation include agitating body trucks, pneumatic unloading system for bulk cement and automatic weighing of batches.

Oklahoma Gravel Plant Operating at Capacity

Production at capacity is in progress at the crushed-stone plant near Pawhuska, Okla., operated by the Concho Sand & Gravel Co. Fifty men are at work, the stone shipped being used in road construction on the state's highways in that vicinity.

Construction Awards Continue to Decline

DROP 26% IN THIRD QUARTER

Exceptions to the rule of a general loss of 26 per cent. in third quarter construction contracts for the 37 states east of the Rockies from the third quarter of 1930 are found in certain construction class gains by F. W. Dodge Corp. Among these gains is a 29-per cent. advance in engineering in upstate New York, 6 per cent. in the same class in the Middle Atlantic district; 34 per cent. in non-residential building in the Chicago territory; 3 per cent. in non-residential and 248 per cent. in engineering in the New Orleans district; and 14 per cent. in engineering in Texas.

Two of the thirteen Dodge territories east of the Rockies showed gains in total construction for this third quarter as contrasted with the 1930 period.

During the month of September, non-residential building was the most important major construction class, forming $112,417,500 of the entire $252,109,700 total for the month. Residential building amounted to $54,552,-800; and public works and utilities to $85,139,400.

An advance over September, 1930, is found in the $21,545,400 total for the upstate New York territory, which compares with $16,039,400 in September of last year. The Southeastern territory gained slightly over September, 1930, with $14,886,100. The district around New Orelans, totaling $6,637,000 for the month, led by more than two million dollars over the comparative month of 1930.

The gain over August in the entire 37 states, when totals were low, was well distributed among various special classes, only public buildings, residential buildings and social and recreational structures, declining under August totals. Of these special classes, commercial buildings amounting to $29,960,200 in September, compared with $19,417,300 in August, $10,969,-600 for September in factories, compared with $4,749,800 in August. Educational buildings amounted to $21,155,100 in September, against $19,266,700 in August. Religious and memorial buildings as well as public works and utilities made better showings for the month just ended.

Contemplated projects as reported during September are under those of both August and of September, 1930. Several districts, however, show slight advances in proposed work over August, 1931, the Upstate New York territory, the Middle Atlantic states, and the Southern Michigan peninsula all producing some go-aheads over the previous month.

The total in contemplated projects reported during September for the entire 37 states east of the Rockies was $222,843,000.

Railroads Ask Lower Gravel, Stone Rates

CLAIM PRODUCERS CAN'T PAY

The Interstate Commerce Commission has reopened for further hearing its Docket 17517, involving rates on chert, clay, sand and gravel within the state of Georgia. In addition, eleven other cases related to that docket have been reopened.

The cases reopened involve rates on the commodities mentioned, as well as crushed stone and related articles, between points in Georgia, South Carolina, Alabama, Tennessee and other states of the south.

The further hearing will be limited to the following questions:

1. Whether one scale of rates should be approved or prescribed in these proceedings for application to both single-line hauls and joint-line hauls of the traffic mentioned in lieu of the two scales, one for single-line application and the other for joint-line application, prescribed by the commission.

2. If one scale for both single-line and joint-line application should be approved or prescribed, what should that scale be in order to yield approximately the same revenue as is being produced from the application of the two scales heretofore prescribed.

3. Whether arbitraries, in addition to the scale or scales which may be approved or prescribed as the result of the further hearing, should be accorded to any so-called short or weak line and, if so, what such arbitraries should be.

The commission has not yet announced the dates and places of the further hearings.

The petitions for rehearing were filed by some of the short lines involved, by the American Short Line Railroad Assn. and others. These petitions said the joint-line scale prescribed by the commission hurt producers located on short lines or on railroads where it was necessary to use more than one carrier to reach destination.

It was said that some producers would be compelled to retire from business if they were forced to pay the higher rates for joint-line movement or for movement from a short line. Instead of inuring to the benefit of the short lines, the higher rates prescribed for them by the commission actually harmed their business. Some of the short lines are almost totally dependent on sand, gravel, or stone traffic for their existence and rates which prohibit the movement of those commodities simply mean their ruin.

Highway Research Board to Meet Dec. 10 and 11

The eleventh annual meeting of the Highway Research Board, National Research Council, will be held on December 10 and 11, 1931, in Washington, D. C. The meetings will be in the auditorium of the National Academy of Sciences, 2101 Constitution Ave. The sessions will be devoted to discussion of reports of research activities in relation to highway finance, transportation, design, materials and construction, maintenance and traffic.

Missouri Road Plan Will Spur Gravel Production

In order to provide employment to employees of sand-and-gravel plants in Missouri during the fall and winter, A. J. Murphy, Earle Ray and other members of the Louisiana Chamber of Commerce have spent some time in Jefferson City in an effort to induce the state highway commission to purchase material to be used in highway construction during the spring and summer of 1932.

The commission was favorably impressed with the plan and advertised for bids for supplying the needed material. The bids were to have been opened about November 1.

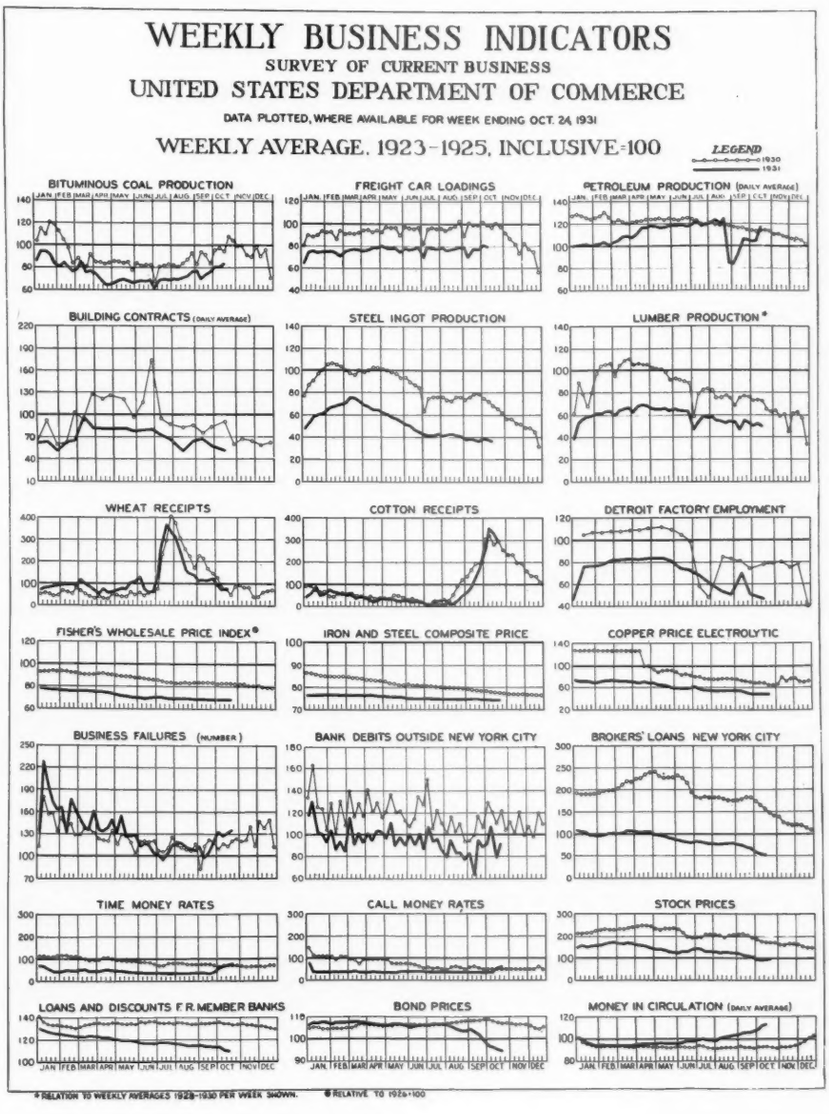
Granite Freight Rates Are Ordered Reduced

Freight rates on granite curbing, paving blocks and rough-chipped bridge granite, in car-loads, from West Chelmsford, Mass., and South Milford, N. H., to points in central, trunk-line and New England territories have been found unreasonable by the Interstate Commerce Commission and a reduced scale of rates ordered into effect.

The commissioners decision was on a formal complaint brought by H. E. Fletcher Co., West Chelmsford, and Lovejoy Granite Co., South Milford, a subsidiary of the Fletcher Co.

Steam Engine in Service 132 Years in Salt Mine

One of the oldest steam engines in operation in Europe is at the Königsborn salt mine near Unna in Westphalia, Germany. It is connected with a pumping station and was installed Aug. 30, 1799. Operation has been uninterrupted, except for a brief period in 1866, when it was completely overhauled.



Editorials

The Decision Goes to the Railroads

THE concessions made by the Interstate Commerce Commission to the railroads in their demand for a flat increase in freight rates have not provoked much enthusiasm among producers of nonmetallic minerals and other commodities similarly affected. While the commission, as was confidently predicted, did not grant the increase asked, it did decide upon flat increases varying with the nature of the commodity carried, thereby admitting in principle the justice of the railroads' plea.

In making its decision the commission was evidently influenced by the claims of shippers as presented by their spokesmen and, in the case of the nonmetallic-mineral industries, the assessment might have been much greater had it not been for the cogent arguments offered by the briefs submitted by the national associations representing aggregate producers. The thoroughness with which these arguments were drafted and the completeness of the evidence tendered in support of them showed very clearly the great service which aggressive and well-organized trade associations can perform in the interest of the industries they represent. Although the facts may never be brought to light, it seems reasonable to believe that the painstaking care and the spirit of fairness evinced by those who spoke for the aggregate industry prevented the granting of even greater increases. In fact, one of those on whom responsibility for the decision rested was outspoken in his praise of the quality of the argument, and others, competent to judge yet not empowered to decide, commented favorably upon both the manner and the content of the presentation.

Faced with the likelihood of being forced to pay the increases granted, producers are giving fresh consideration to the relief that they may obtain through the use of motor trucks. Where the advantages of truck shipment are already understood, a further diversion of traffic from the railroads to motor trucks can confidently be expected. Where they are but vaguely talked of, intelligent study of the motor truck's qualities is certain to be made. Both forms of action will result in considerable damage to the railroads and may even counterbalance—if the comments of many producers are followed by the action they promise—the gains taken by the roads. The temper of shippers, in other industries subjected to similar increases just as our own industries, has already suffered too much straining from the losses of reduced business to accept the commission's decision without protest. The argumentative type of protest has already been presented; the retaliatory form is yet to be made; and only time can tell which will prove to have been the more effective.

While shippers as a class are no less aware than others of the important service rendered to the country by the railroads, the latter make a very weak plea for support when they base their arguments so largely on the extent of this service in the past. Shippers in every industry are more interested in the costs of transportation than they are in the historical background of the different forms available, and, on that account, can be expected to utilize the form which is the most useful, service and cost considered. Any form of transportation that fails to meet these requirements, either partially or entirely, must not complain if it finds itself displaced or encroached upon by other forms that meet those requirements more completely. Each form must justify itself economically and the tests by which each will be judged are now, and in the future will be, more rigid than they have ever been.

In times of prosperity costs are not too closely scrutinized and many inefficient machines and processes are tolerated because their excessive costs are hidden in abnormal rates of profit. But in times like these the losses of falling prices must be recovered at some point and, while the profit-scales of prosperous times can absorb some of these, the rest must be recovered from costs. Machinery and processes are therefore being studied more carefully than ever before and no method which fails to justify its first and operating costs is likely to be long retained. Transportation, like every other process in industry, will be subjected to the same critical analysis and the cheapest and most serviceable method will win.

Furthermore, the railroads chose an inopportune time for the presentation of their claim and they will suffer from the ill-will that naturally falls on any service which seeks to increase its charges in the face of declining prices in other lines. Shippers whose commodities suffer from downward price movements could not be expected to favor a rising scale in transportation or any other costs. The railroads were in the favorable position of having their rates maintained by law and they felt merely the losses resulting from a shrinkage in business. General business, not so favorably situated as regards government price stabilization, suffered not only a shrinkage in business but a sharp fall in prices. The railroads, therefore, were asking for protection against the normal risks of declining business in addition to their government-insured protection against declining prices, and in so doing they forfeited the good-will of shippers and the general public.

If the railroads were entitled to an increase in rates based on an analysis of the costs of the various services rendered by them, their plea would have come with better grace and certainly with better reason before the slackening in business, when prices were higher than those existent at the time their petition was filed. It probably would

have been possible to show economic justification for a substantial increase and its petition would undoubtedly have had a larger measure of support from those asked to defray the higher cost. We voice the opinion of thousands of shippers, in other industries as well as our own, when we say that a plea for higher rates was unwarranted by the state of general business (on the success of which the railroads depend) and that it was probably unwarranted when judged by a study of costs and rates. Many of those who have made a careful examination of the railroads' arguments and evidence have not been able to share the commission's view of the need for increases and feel that the commission displayed an unnecessary and unwarranted consideration for the railroads. There are many industries that would gladly raise their prices under present conditions, even if only to replace them on their former levels, but none of them, as far as we know, have sought to raise them above former levels. Yet this is precisely what the railroads have attempted to do and, to the extent that the commission has helped them, they have succeeded. They will have more difficulty in convincing the shipping and buying public than in convincing the commission of the justice of such a plea and of such a decision.

Not content with the results attained—since these obviously fall considerably short of the 15-per cent. increase requested and since, also, the gains are to be pooled and, so, inure to the benefit of the small as well as the large railroads—and fearful of the rapidly increasing seriousness of motor-truck competition, the railroads will redouble their efforts for greater restrictions of highway transportation, according to reports. The theory is that the railroads must be supported at all costs and that newer forms of transportation, even if superior and cheaper, must be held down with unnecessary burdens in order to equate the differences that exist between inefficiency and efficiency. The public must be penalized by being forced to pay higher prices for transportation service than the cost of such service warrants, and the advantages of improved engineering and machinery (as exemplified by modern highway transport) must be nullified either by forbidding their use or by raising the cost of their use to the cost level of inferior means.

In addition to the normal desire of shippers to use the most economical means of transport, the railroads have created a spirit of resentment, which, while it may not drive shippers to the adoption of uneconomical expedients, will certainly urge them to a more analytical study of transportation costs, and such an investigation is not likely to benefit the railroads. Railroad transportation has held much of its patronage through no more substantial claim than that of habit, but in these times many habits, however well-established, are destined to be challenged and changed and this tradition is certain to be one of them. Railroad transportation will be forced to justify itself on a cost basis and, in view of the new rates, it will be increasingly difficult, and in some cases impossible, to do so.

A Great Burden Lifted

THE decision of the Supreme Court of the State of Illinois declaring unconstitutional the state law governing the letting of highway contracts has given important, although somewhat tardy, relief to a situation that promised to become as costly as it was ridiculous. Many millions of dollars of road building can now proceed, free from the delays incident to legal controversy over the legality of the prevailing-rate-of-wages law, but subject to the obstacles soon to be offered by seasonal conditions. The latter consideration makes the delay in obtaining the court's decision a cause for concern to all who are interested either in the reduction of unemployment or in the stabilization of the industries involved. It was unfortunate that the controversy arose at a time when employment and business were so badly needed and that the relief comes too late to make its advantages applicable to this year's problems.

Had it not been for the attempts of many contractors and others to take advantage of the times by reducing wages, it is doubtful whether state legislatures would have interested themselves in the problem of wage scales, although in a few states wage-rate laws have been operative for several years. At present about a dozen legislatures have passed, or are considering the enactment of, wage-stabilization laws and in some other states, although no law covers the subject, highway contracts contain wage-control clauses.

In those states which have suffered from delays resulting from wrangling over the legality of wage legislation the damage that has followed probably exceeds the benefits which, it was hoped, would come from wage control. In their desire to depress wages contractors and others showed a complete lack of what has been called "enlightened self-interest," for the delays that have resulted are likely to cost them more in the end than the difference between proper wages and those they were willing to pay.

Experiments in government wage control are not likely to prove more helpful in other cases than in those where the evil effects have been striking, unless they are born of sensible legislation and are administered by intelligent officials and engineers. The phrase "prevailing rate of wages" introduces more complications and opportunities for dispute than could probably be offset by the advantages gained, and yet the alternative method of embodying in the specifications a statement of the wages to be paid can be criticized on other grounds.

This question indicates another of the many fields where trade associations, if properly empowered by government authorization, could render signal service to society as well as to their members. As Mr. Kelsey indicates in his article in this issue, regulation by trade associations is far less offensive to business men than regulation by government, yet it could be just as effective if trade associations were cloaked with the authority necessary to adopt policies and enforce them.

Plant in Switzerland Receives Stone by Tramway from Mountain Quarry

Crushing-and-Screening Operations Are Developed to High Degree of Perfection

By HANS LEIMBACH

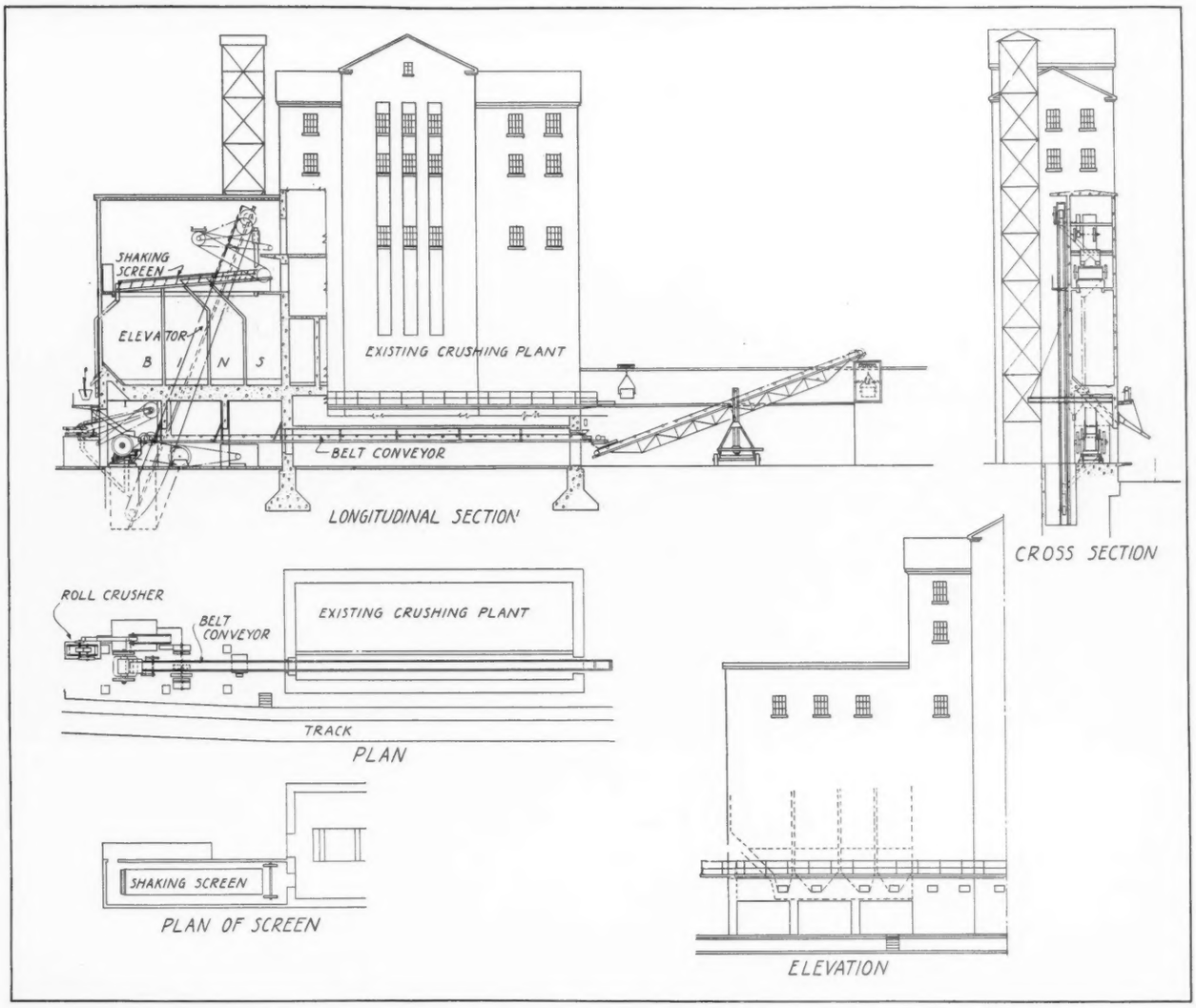
THE Buchs stone plant in the canton of St. Gallen, Switzerland, lies above the Buchs railroad station in the Rhine valley on the international railway from Zurich to Vienna; Buchs, in fact, is the international boundary and customs station between Switzerland and Austria. The plant was built in the years 1925 and 1926, and was placed in operation in the spring of 1926. The machinery installations are among the most modern in Switzerland and are distinguished by large scope and simple construction. The producing capacity after the recent enlargement during the year 1930 reaches 1,400 to 1,500 metric tons per daily shift of 10 hr.

Airplane view showing plant in foreground and quarry at top. The line of the aërial tramway is just visible.

The quarry site is on Buchs Mountain some 650 m. (2,132 ft.) above the sea or 200 m. (650 ft.) higher than the Buchs railway station, and is about 1,700 m. (5,575 ft.) distant, as the crow flies, from the loading station. The stone that is quarried is a very hard quartzite sandstone with an average compressive strength of 3,620 kg. per sq. cm. (51,400 lb. per sq. in.). Quarrying is done on three levels and can later be increased by further benches, as the deposit is very large and continues about 100 m. (328 ft.) higher. The width of the quarry is at present 300 m. (984 ft.) and the total height of the three faces 70 to 80 m. (230 to 260 ft.). Since the quarrying and the loading of the stone are carried on for the most part by hand, 120 men are employed in the quarry.

The deposit is very dense and scarcely seamed, so that considerable drilling and blasting must be done. In this work compressed air hammers are used exclusively; in normal operation ten of them are at work, fed by three compressors. All compressed-air conduits are placed underground. A large blacksmith shop, which is equipped with a sharpening and upsetting machine, serves for sharpening and forging the drills. The drill holes are driven to a depth of 7 m. (23 ft.), then sprung so that they will provide room for enough explosive to attain the required blasting force. The charges are fired individually by means of detonating fuse, or also in series by means of electric detonators. Some of the stone shot down from the face is so large that it must be broken again by means of cap shots or secondary drill shots to obtain the proper feed size for the crusher. On the lowest level the quarried stone is hand-loaded by piece-work laborers directly into the buckets of the aërial tramway, which for this purpose are lowered onto wheeled underframes.

On the two upper benches the stone is loaded into ¾-cu.m. (approximately 1-cu.yd.) lipped rocker cars which are moved, on the top level by hand and on the lower level by a Diesel-engine locomotive, on tracks of 600-mm. (24-in.) gauge, to a receiving bin where the cars are dumped. The receiving bin has a capacity of several thousand cubic meters of stone and thereby makes possible a uniform feeding of the aërial cableway. The stone stored in the receiving bin is drawn off by means of sliding gates and chutes into the cableway buckets. On the third



Elevation and details of the new fine-crushing department adjoining the main crushing building.

and highest level a preliminary crushing plant was installed last year, and the ¾-cu.m. (1-cu.yd.) cars are pushed directly to it. On this level the cars are moved by hand; on the two lower levels, however, they are pulled by a 10-hp. and a 20-hp. Diesel locomotive, as previously mentioned.

All operations at the quarry face, even the drilling, are arranged on a piece-work basis.

On the lower level, as was mentioned above, cableway buckets which are lowered onto truck-frames are used exclusively for the transportation of the quarried stone. This arrangement is of much interest, and is worth a brief description here.

The buckets of the aërial-cableway carriages are automatically lifted off the inclined terminal by a very judicious proportioning of the height interval between the tramway rails and the tracks of the under-frames. *Vice versa,* the buckets are removed from the under-frames by the tramway incline when they come in contact with it, and thus form again the complete tramway carriage.

In addition to crushed stone and quarry-run stone, paving stone is also produced in this quarry. The paving stones are made in dressing sheds and are produced entirely by hand from blocks which are first split to the desired size by appropriate splitting devices. In this work large and strong hammers weighing 8 to 10 kg. (18 to 22 lb.) are employed. The final dressing of the blocks is entrusted to skilled workers with smaller hammers weighing 2 kg. (about 4½ lb.). The stones are classified according to size as large and small paving blocks and mosaics. As the rock at Buchs is very hard and, in addition, possesses a very coarse surface, the paving stones from Buchs are much in demand. Paving stones are particularly used in Switzerland for heavily-traveled streets, and especially for curves.

A particularly interesting feature of the quarry not yet mentioned is that the utilization of space is very efficient. Thus, the compressors are installed in the substructure of the cableway terminal; in the same place, furthermore, a large store-room is provided.

As the workers employed in the quarry live at considerable distances, large lunch-rooms and canteens are provided on the property. The commissary is on a self-sustaining basis, that is, each worker receives a very good meal at actual cost.

The main crushing plant and storage yard before the fine-reduction department was added.

Under this arrangement it is possible for the workers to receive excellent food at low prices.

For the transporting of the stone that is loaded at the quarry face, and also of the stone that is crushed at the quarry site, to the railway loading station, an aërial tramway (bicable system built according to patents of the Adolf Bleichert Co.) is employed. The carriages, known as "4-wheeled couplers," have buckets with a capacity of about 500 l. (about 18 cu. ft.) each, and are attached automatically, by means of appropriate rail guides for the coupling apparatus, to a traction cable which hauls the buckets to the unloading terminal 1,700 m. (5,575 ft.) distant. This terminal lies 200 m. (650 ft.) lower than the loading terminal at the quarry, so that the loaded carriages not only draw the empty ones back up to the quarry but, in addition, the system has a power surplus of 50 hp. This power is fed into the main transmission system through a differential drive. The traction cable employed has a diameter of 24 mm. (about 1 in.), the track cable for the empty buckets a diameter of 38 mm. (about 1½ in.) and the track cable for the loaded buckets a diameter of 42 mm. (1.68 in.). The traction cable travels at a speed of 2.3 m. per sec. (about 450 ft. per min.), and the buckets travel at intervals of 30 sec., or about 225 ft. The track cables are supported by steel towers, the highest of which is 30 m. (98 ft.) tall. Since the line passes over highways and public roads, protective structures are provided in addition to the supporting towers.

The hourly capacity of the tramway is, as already mentioned, 150 metric tons (165 English tons). The unloading terminal of the tramway at the plant lies 28 m. (92 ft.) above the top of the railroad rails. Here also the track cables and the traction cable are kept always in uniform tension by means of heavy tensioning counterweights, so that irregular loadings of the system are thus avoided.

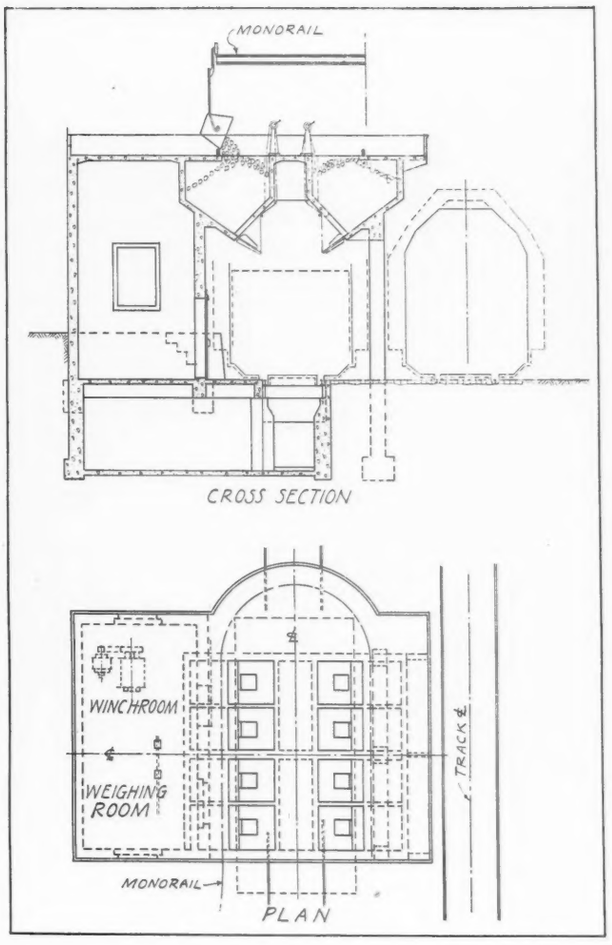
The tramway system is interesting also in that, for the sake of longer life of the traction cable, it is provided with a positive drive which, like the differential in an automobile, equalizes the increased stresses in the traction cable which arise occasionally on account of varying loads.

As was briefly mentioned before, there are several crushing installations in the Buchs works. Thus, there is a preliminary crushing plant of particularly interesting construction installed at the quarry itself. This installation can be visualized very well from the accompanying drawings. A jaw crusher with a jaw opening of 850 by 500 mm. (34 by 20 in.) stands on the upper level of the quarry. The stone quarried on this level is loaded into the rocker cars by hand and pushed by the workers on tracks of 600-mm. (24-in.) gauge to this crusher, into which the material is discharged direct. The crusher reduces the raw material to an end size of 120 mm. (4.8 in.) maximum. This material falls through a chute into a rotary preliminary-sizing screen 1,500-mm. (60-in.) in diameter and 8 m. (26 ft.) long, which, for the sake of better sizing, is also provided with a jacket screen. With this screen the following sizes are produced: 0 to 15 mm., 15 to 45 mm., 35 to 80 mm. (roughly 0 to ⅝ in., ⅝ to 1¾ in., 1⅜ to 3¼ in.) and "oversize." Of these sizes the 35-mm. to 80-mm. and 15-mm. to 45-mm. materials fall into long inclined

bins which extend down to the first level and are about 55 m. (180 ft.) long. The capacity of each of these bins is 380 cu.m. (495 cu.yd.). To carry out this arrangement of the bins, channels had to be blasted in the quarry walls, to which the bins are anchored; the advantage taken of the sloping ground, however, avoids the need of a mechanical conveying system. Naturally, the bins, built of reinforced concrete, are provided at their sliding surface with a lining of paving stone set in step form to prevent excessive wear.

The "oversize" falls likewise into an inclined bin of shorter length, so that it can be conveyed in dump cars on the second level to storage in the quarry-run stone bin. The 0-mm. to 15-mm. material also falls into a small inclined bin, at the end of which, however, is a vibrating screen 2 m. long and 1 m. wide (80 in. by 40 in.), which screens out the dust from 0 to 3 mm. (0 to ⅛ in.) in the quarry. The material falls into a funnel-shaped hopper from which the waste is carried to the dump. The stone from 3 to 15 mm. in size falls to a horizontal belt-conveyor which feeds this material also into an inclined bin, through which it slides down to the lower level. This belt-conveyor is driven by an electric motor which drives the conveyor head-pulley by means of a "Pekrun" drive—a special worm-gear drive which has an efficiency of 97 per cent.

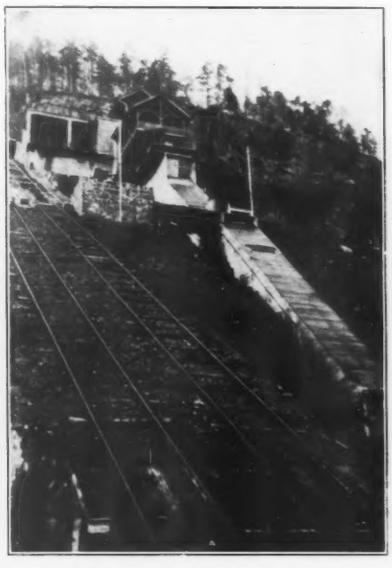
This preliminary crushing plant is operated by electric current, which is stepped down in the plant's own transformer station from 6,000 v. to the operating tension of 380 v. A 100-hp. electric motor drives the rotary screen and the crusher through a group drive, which also serves the third stand-by compressor. The vibrating screen at the end of the dust bin is driven by an individual 5-hp. motor. On the bottom level the material is fed, according to demand, either by means of sliding cut-off gates and chutes into the cableway carriages, or several meters higher through other gates into quarry cars by which it can be discharged to storage.



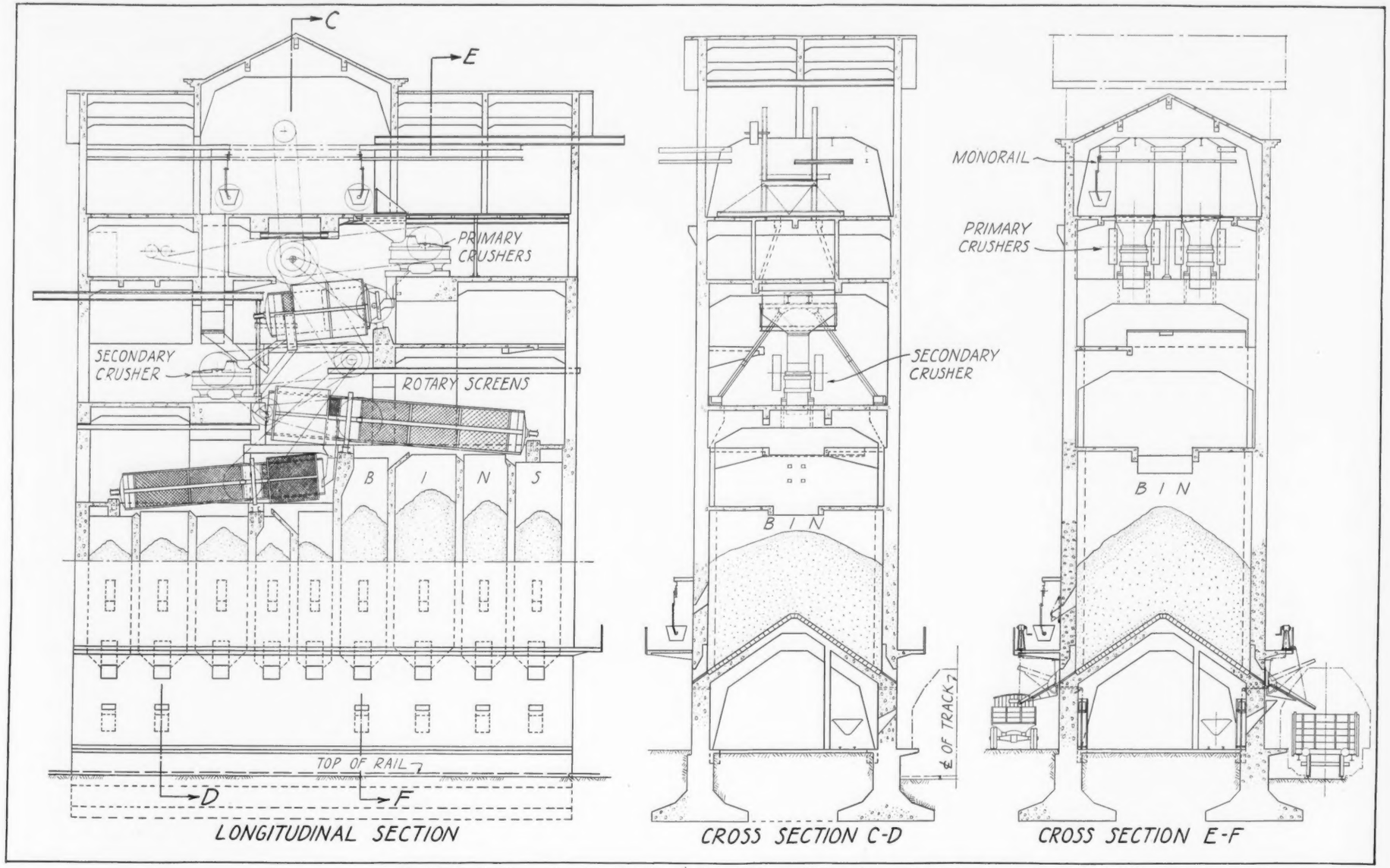
Plan and cross-section of the loading building.

This preliminary crushing plant at the quarry is the only one in operation at times of low demand. With the beginning of the busy season, however, the main crushing and screening plant at the loading tracks, located at the end of the aerial tram in the valley far below, must be made ready for opera-

The fine-reduction department at the left was added last year. Note the clean, compact appearance of the plant.



Primary crushing plant at quarry, showing inclined silos.



Sectional drawings showing details of the main crushing-and-screening plant.

tion. This large crushing and screening installation is located in a large reinforced-concrete building, 32 m. (105 ft.) high and 22 m. (72 ft.) long. The tramway line enters at a height of 27 m. (88 ft.) above the railway tracks. Here the incoming tramway carriages, after being disconnected from the traction cable, can be released from the suspension rails by means of switches, according to the content of the buckets. The large stone and the "oversize" from the preliminary crushing plant are fed to the hoppers of the two primary crushers of 850-mm. by 500-mm. (34-in. by 20-in.) jaw opening. The paving blocks, on the other hand, can be lowered by means of a braked cage direct to a loading ramp, from which they are carried immediately to the railway cars by means of overhead conveyors. The sized materials produced in the preliminary crushing plant at the quarry, however, can be delivered into the respective storage bins, or, if required, can of course be fed again into the screening equipment of the main plant.

The two primary crushers of the main plant reduce the stone to a maximum size of 12 to 15 cm. (4¾ to 6 in.). The material which they crush falls into a large preliminary-sizing screen below, 2,000 mm. (80 in.) in diameter and 4 m. (13 ft.) long, which is provided with a solid jacket. Here the material from 0 to 80 mm. (0 to 3¼ in.) is screened out and is chuted direct into the large-stone screen. The "oversize" likewise is automatically fed to an 850-mm. (34-in.) crusher which is directly below the preliminary screen and reduces the "oversize" to a maximum size of 90 mm. (3⅝ in.). This secondary-screened material likewise falls by means of a chute into the large-stone screen, which has a length of 12 m. (40 ft.) and a diameter of 1,800 mm. (72 in.). The construction of this trommel is particularly interesting because it is supported at only three points. The fore part of the trommel is provided with a blank jacket, which catches the 0-mm. to 20-mm. (0-in. to ¾-in.) material which is screened out first and is then chuted to the fine-stone screen below.

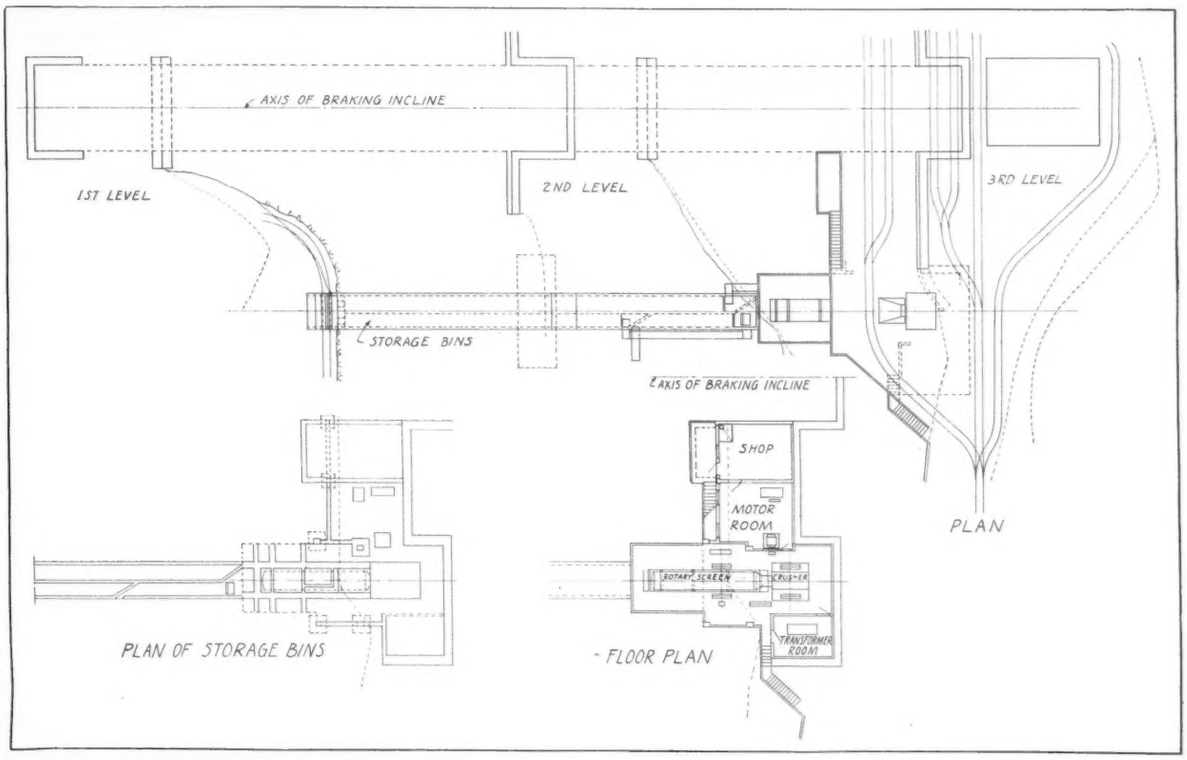
Besides this material, the large-stone screen produces sizes of 30 to 40, 40 to 50, 50 to 70 mm. (roughly 1¼ to 1⅝, 1⅝ to 2, 2 to 2¾ in.) and "oversize." For each of these sizes a large bin is provided underneath, in which all materials can be stored until they are loaded directly into the railway cars.

In the fine-stone screen, 1,500 mm. (60 in.) in diameter and 8 m. (26 ft.) long, which also has a jacket, the following fine sizes are screened out: 0 to 4, 4 to 8, 8 to 12, 12 to 17 and 17 to 25 mm. (roughly 0 to 5/32, 5/32 to 5/16, 5/16 to 1/2, 1/2 to 11/16 and 11/16 to 1 in.). This trommel is supported at only three points and is driven at approximately the middle or most favorable point.

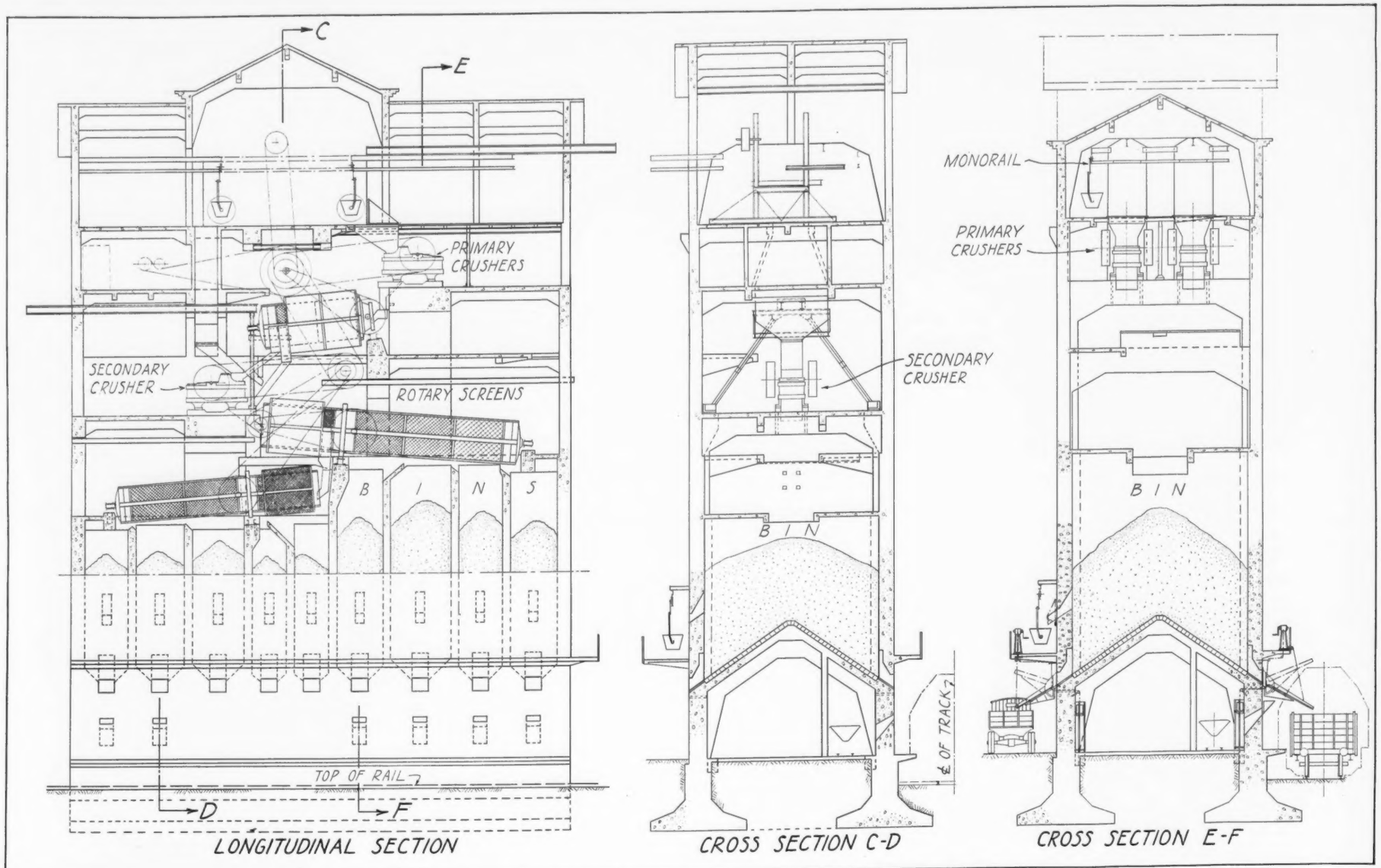
Thus, as this brief sketch of the flow of material in the main plant shows, care was used in the construction of the plant to utilize for transportation, as far as possible, the cheapest form of power—gravity. In this way an excellent layout of the whole system was accomplished.

The hourly capacity of this plant is 110 metric tons (121 tons), to which must be added the capacity of the preliminary plant in the quarry.

Only one electric motor of 175 hp. is needed for



Plan of the primary-crushing plant and the quarry.



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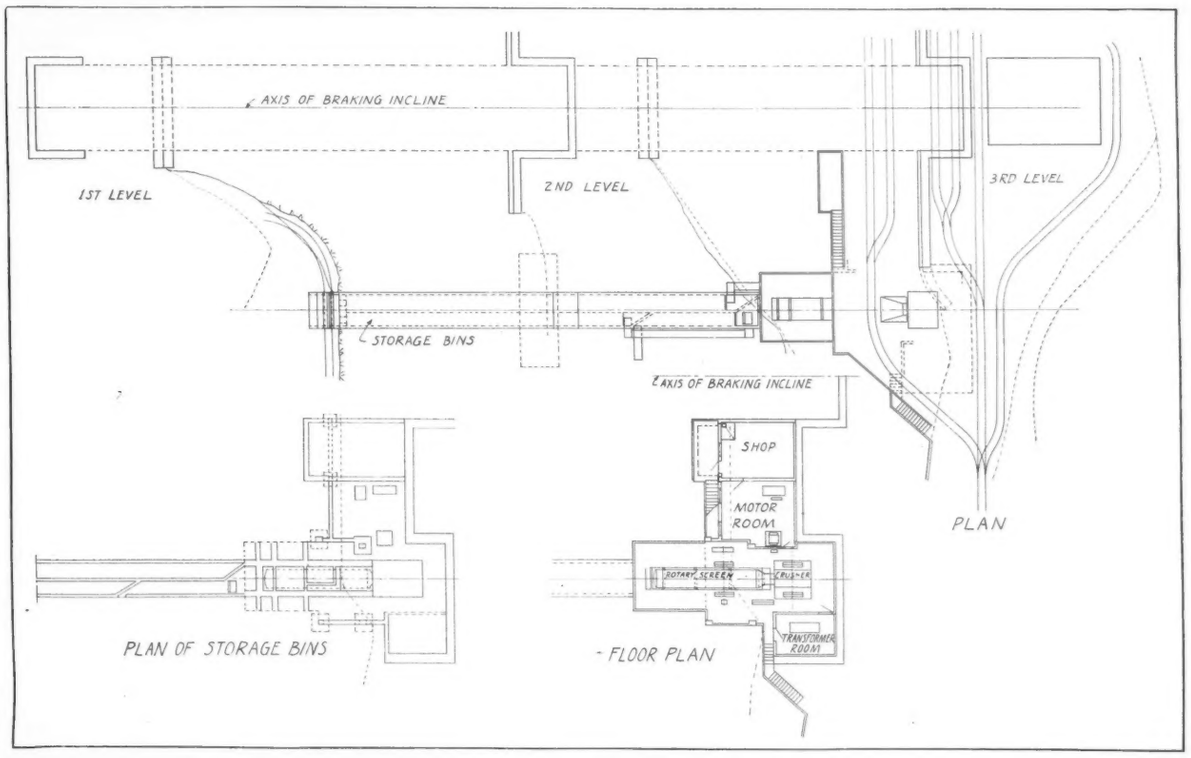

Plan of the primary-crushing plant and the quarry.

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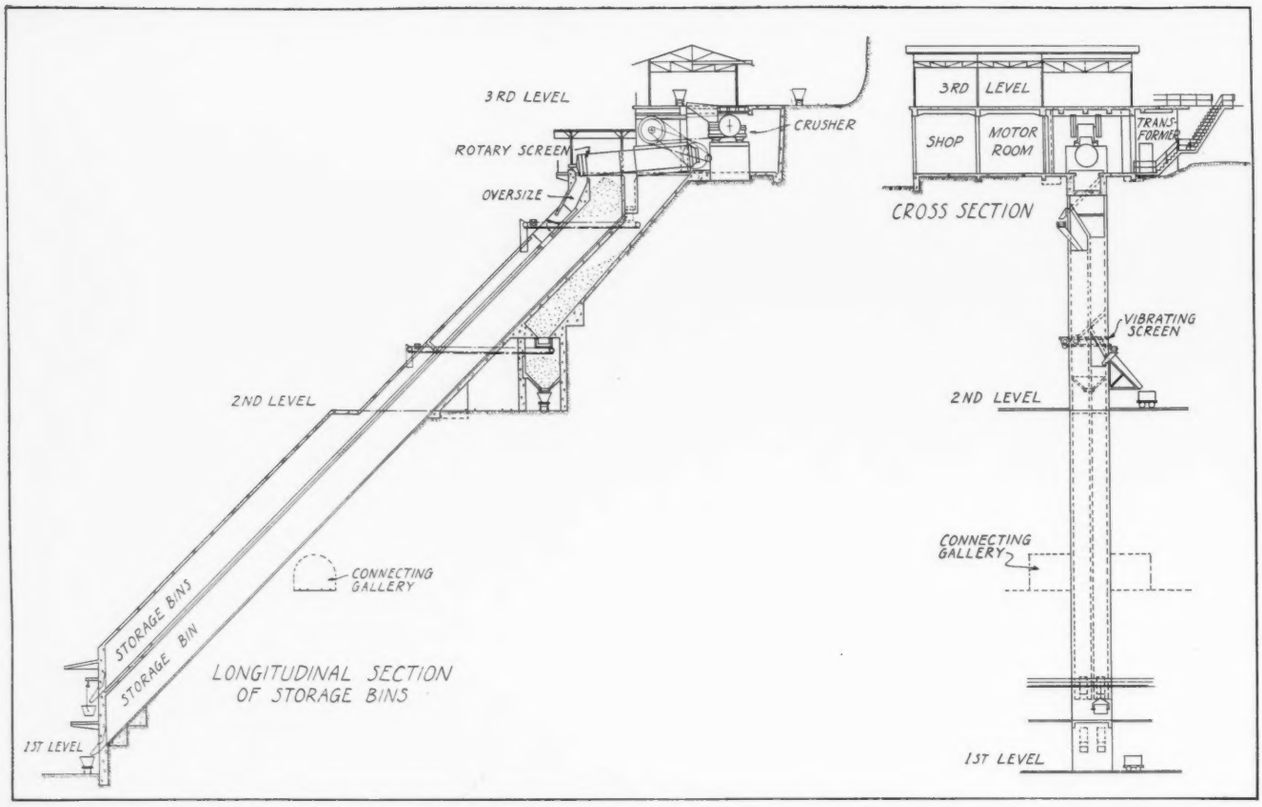
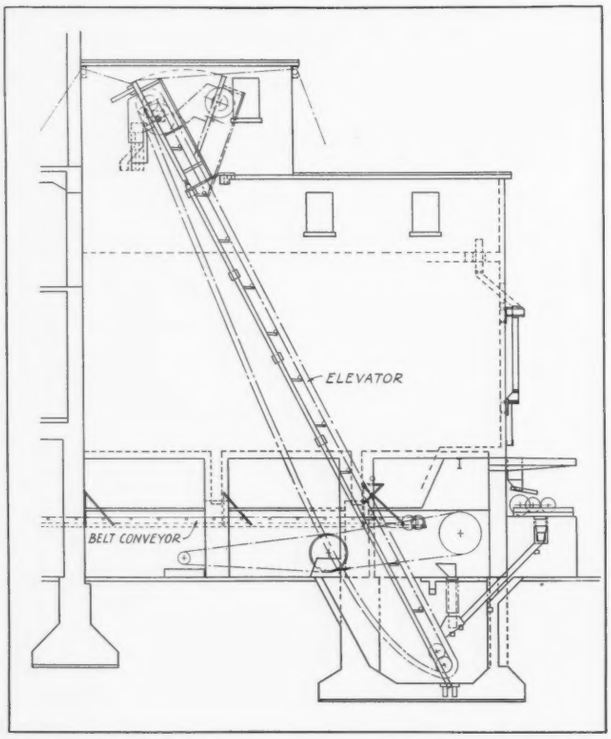


The primary-crushing plant and inclined storage bins at the quarry.

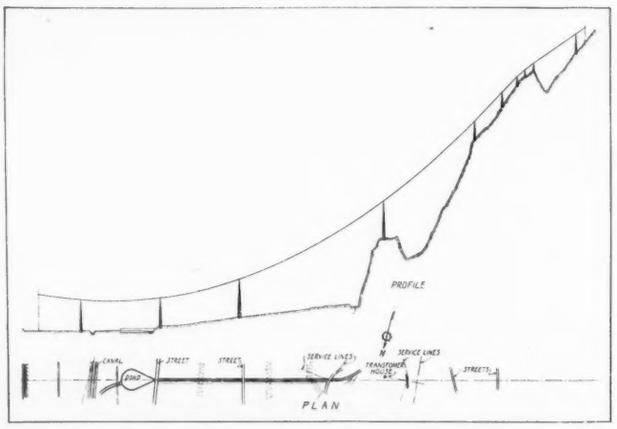
driving the equipment of the main plant, but this is supplemented by the 50 hp. generated by the cableway system. Thus, the entire power consumption of the plant should be fixed at about 220 hp., which, it will be seen, is quite small in view of the fairly large crushing capacity.

The electric motor is mounted on the second highest (next-to-the-top) story of the plant, as can be seen in drawings, and can be stopped by push-buttons on all floors. For the communication of the operators when starting the motor, furthermore, speaking tubes are installed, so that even in the loudest noise the workers can understand one another clearly. A telephone line connects the two terminals of the aërial tramway and, in addition, certain signals are arranged for regulating the operation and the stopping of the equipment.

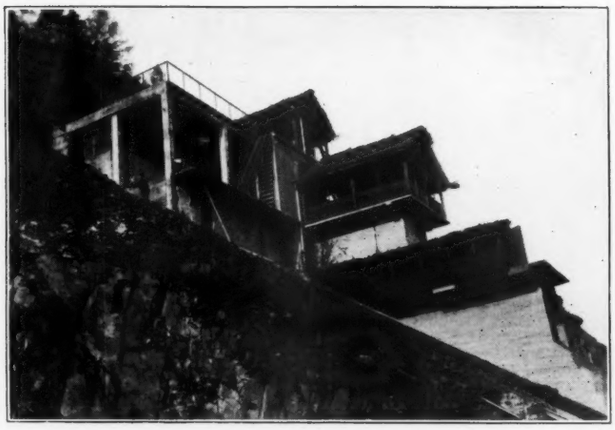
To meet the new demands of modern bituminous-



Rear-view section of the elevator building at the main crushing plant.



Profile and plan of the aërial tramway.



Another view of the primary-crushing plant.

road construction, it was necessary in 1929 to add to the plant a department for the production of improved fine stone for bituminous aggregate. This plant is likewise constructed of reinforced concrete and is erected at one side of the original plant in such a way that the installation is not harmed in its architectonic aspect on account of the addition. This new plant produces quite small stone sizes which are employed in the production of the bituminous mortar for bituminous-road surfaces or rolled-asphalt streets.

For the production of this fine cubic stone material a grinding mill ("granulator") of 1,000-mm. by 200-mm. (40-in. by 8-in.) feed opening is employed. This is mounted under the new bins and is fed by a long belt 500 mm. (20 in.) wide which runs past all the bins of the original plant. Material from any of the bins, and in size from 0 to 50 mm. (0 to 2 in.) can be fed to this belt, and then broken down in the mill to 20 mm. (a little over ¾ in.). The broken material is lifted by an elevator about 24 m. (79 ft.) long between centers, and is chuted to a small vibrating screen about 2 m. long and 1.20 m. wide (about 6½ by 4 ft.). Here the dust from 0 to 2 mm. (0 to about 12 mesh) is screened out and falls directly to the "sand" bin provided for it.

The material over 2 mm. falls through two chutes to a larger flat screen about 12 m. (39 ft.) long. This is so arranged that two separate screens, which are actuated by cranks, swing in opposite directions. Because of this type of construction the effects of gravity are counteracted, so that a quiet operation of the screen is assured. The whole frame rests on wooden springs which accelerate the backward motion of the screen. It is to be noted that the movement of the material is entirely horizontal, so that there is no drop in height in a length of 10 m. (33 ft.). The screen is 1,800 mm. (72 in.) wide and makes the following separation of sizes: 2 to 5, 5 to 10, 10 to 15 and 15 to 20 mm. (approximately 12 mesh to 5 mesh, 5 mesh to 13/32 in., 13/32 to 5/8, and 5/8 to 13/16 in.). The "oversize" from the screen is chuted to a roll-crusher which stands near the granulator. In this roll-crusher the "oversize" is again broken down, and the resulting material is again chuted to the elevator, closing the circuit of the screening and pulverizing.

The bituminous-aggregate plant is operated by several electric motors. The granulator and the roll-crusher are driven by a 65-hp. motor, the long belt-conveyor by one of 4 hp., the elevator by one of 25 hp. which also drives the flat screen that extends somewhat into the old plant; the small vibrating screen is driven by a ½-hp. motor.

The capacity in high-quality fine stone is 200 metric tons (220 English tons) per 10-hr. shift, so that, in case of greater demand and longer operating periods, the greater part of the average-sized material from 20 to 40 mm. can be converted to bituminous aggregate.

As was briefly mentioned previously, the plant bins are so arranged along the railway that all materials can be loaded by means of sliding gates and chutes into the railway cars standing on the plant switch tracks. The cars are shifted in the yard by means of a powerful car-puller winch. The weighing of the cars is accomplished on a sturdy track scale of 40,000-kg. (88,000-lb.) capacity. To make possible a good loading of all railway cars a small reinforced-concrete building containing eight bin pockets was erected over the track scale. In these pockets are stored supplies of all the sizes that are shipped, so that if the load is short in weight the weigher can simply feed the needed material into the cars from the reserve bins. After the loading is completed the cars are picked up by the Swiss union railway from the switch track and hauled to the Buchs station.

Because of the situation of the plant near the international boundaries, the principal markets for the Buchs stone plant are in Switzerland, Germany and Austria. Because of the modern equipment and the well-laid-out arrangement of the plant the manufacturing process is very simple and on that account the production costs are also very low, so that a large sales territory can be covered.

All the mechanical equipment of the plant was furnished and installed by the Josef Voegele Akt.-Ges., formerly "Rheinguss," of Mannheim, Germany. The electrical equipment was in charge of Brown, Boveri & Co., of Baden. The conveying equipment, cableway line and braking device were supplied by Adolf Bleichert & Co. Akt.-Ges., of Leipzig.

OPERATING with equal economy as a complete ready-mixed-concrete plant or as a batching unit for aggregates alone, the new operation of the Fort Worth Sand & Gravel Co. has a number of interesting features. Turn to page 29.

European Observer Notes Trend Toward Consolidation of Cement Firms

By FRANCIS M. MANSFIELD

THE world's cement industry was considered of enough importance as a basic role in world affairs by the Economic Section of the League of Nations to warrent sifting analysis at this time, particularly with respect to its European elements. Post-war changes have brought about a new geographical distribution of manufacture which did not exist previously and there is a marked tendency toward rationalization and combination, the larger concerns absorbing the smaller.

THE author of this article, a European press correspondent, is a keen student of economic and industrial conditions. His views regarding the situation on the Continent are from first-hand observation and PIT AND QUARRY is pleased to be able to present for the benefit of its readers this article regarding the intertexture of Europe's cement industry.

Germany is the largest manufacturer, with an output of above 7,000,000 metric tons, France following with 5,100,000; then Great Britain, 5,000,000; Belgium and Luxembourg, 2,800,000; Italy, 2,600,000; Czechoslovakia, 1,500,000; Spain, 1,100,000; Denmark, 643,000; Switzerland, 537,000.

With the exception of the figures for Germany, all show notable increases above pre-war days; France nearly tripled, Great Britain and Italy doubled their outputs.

The industry is now definitely organized into national and, in some instances, international associations or cartels. European economic experts believe that there is a reasonable justification for agreements within the industry, due to the progressive mechanization of the plants, from the extraction of the raw material through the various processes of manipulation to sales and distribution.

Fixed costs have been increased inordinately in relation to other charges, yet, on the whole, prices have been reduced. This explains the effort toward working at capacity in order to meet this charge and a continually-growing competition. In turn this has led to the adoption of multiple agreements, the alternative being the ruin of the industry. Reciprocal dumping by the industries of contiguous countries had again led to the searching for new and more distant markets and accounts to no small extent for the drop in American cement exports as compared with pre-war figures.

Syndicates and trusts located in various European countries, as a consequence of the new order of things, have agreed on many points of mutual concern.

Germany's internal organization is in the hands of the Nord-deutscher Zementverband at Berlin, with sales offices at five strategical points within the country, the Westdeutscher Zementverband at Bochum, the Süddeutscher Zementverband at Heidelberg and the Hutten Zementverband at Düsseldorf. The sale and distribution of quotas is accomplished solely by these associations, which embrace, with few exceptions, nearly all the industry, the exceptions being mostly bound to the cartels by friendly agreements.

In Spain the Asland Compania General de Asfaltos y Portland controls about 40 per cent. of the country's cement output. The most important Spanish producers have established a common sales office, which may be considered as a preliminary step towards the founding of a close-coupled trust.

Belgium's Union des Cimenteries is regulated by the statutes of a co-operative and by agreement. It includes nine important concerns operating sixteen plants. Direct sales are made by the separate plants to countries outside Belgium, Luxembourg, France, Germany and Holland. There is a federation of companies adhering to the union, except that its sale activities are confined to the distribution of the joint product of its members in all countries not reserved for the union. Furthermore, there exists, under the provisional title of Comité des Ententes, an autonomous organization including practically all the Belgian Portland-cement plants. Its purpose is to regulate various agreements concluded with the cement industries of foreign countries. Still another group of Portland-cement manufacturers occupies itself with propaganda for popularizing the use of "armored cement," or reinforced concrete. Within this group, which has been organized essentially for publicity purposes, are found 28 of the existing 33 Belgian factories.

Great Britain's industry is almost wholly within the confines of a trust, controlling about 90 per cent. of the country's entire production facilities and output. There are two groups, known respectively as the Red Group and the Blue Group. These groups hold all the shares of the Tolteca Co. in Mexico, and various other branches through the world. They are exceedingly powerful financially and have unified prices, delimited sales areas, and eliminated competition between their units.

Poland's cement industry has its thirteen major plants joined in the Centro-Zement Syndicate.

Switzerland's industry is an organized cartel, centralized in the Eingetragene Genossenschaft Portland at Zurich. Each factory in the cartel has a delivery quota based on the total Swiss output. Another all-embracing organization is the Association Suisse des Fabriques de Ciment Portland.

(Continued on page 48)

A general view of the plant. The office building is at the left.

Pioneer Ready-Mixed-Concrete Producer Erects New Fort Worth Plant

Aggregate Batching or Complete Mixing of Materials Affords Broadened Market

By W. E. TRAUFFER

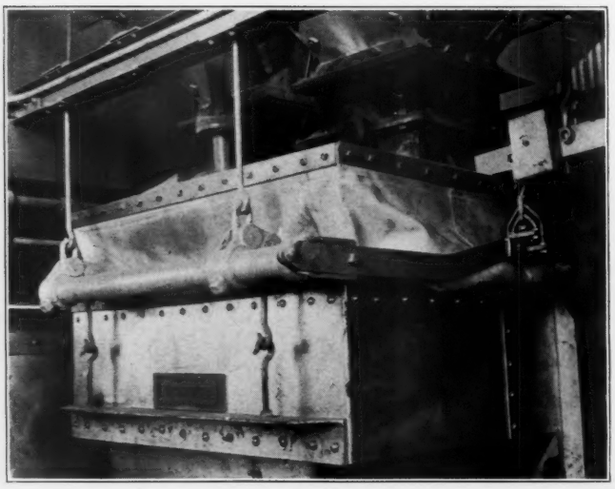
THE Fort Worth Sand & Gravel Co. of Fort Worth, Texas, in the language of the day, has "done it again." This company created a stir in the sand-and-gravel industry in the autumn of 1929 with its new gravel plant at Hart Spur, 9 mi. northeast of the city. This plant involved a number of seemingly radical methods of handling and processing aggregates which have since proved their value in almost two years of operation. The soundness of the design of this plant is evidenced by the fact that no changes of any consequence have been found necessary, which is unusual even in much smaller plants of conventional design. A few additions have been made to give added live-storage capacity, but the fundamental design remains unchanged.

The company has again made a noteworthy contribution to the progress of industry, this time in the form of a central-mixing concrete plant. This new plant, which went into operation on April 15, 1931, does not differ radically from the conventional type of plant, yet it does have a number of original features. Chief among these is the fact that it can operate with equal economy as a concrete plant or an aggregate-loading plant, or both. Operating as a concrete plant, it has a capacity of 100 cu.yd. of fully-mixed concrete per hr. with an added capacity of 80 cu.yd. of dry aggregates per hr. When the mixer is not in operation, it has a loading capacity of 200 cu.yd. of aggregates per hr. The plant is of the most permanent type of construction and is built entirely of concrete and steel. Several thousand square feet of concrete slab under and around the plant and leading to the street make this an all-weather operation.

The new plant is located at Sixth and Terry Sts., Forth Worth, alongside the C. R. I. & P. Ry. yards and less than ½ mi. from the business center of the city. It replaces the company's former plant at Seventh and Terry Sts., which had been in steady operation since March, 1922. This plant was completely torn down, the only equipment salvaged being the 1-cu.yd. mixer. The company is one of the pioneers in the ready-mixed concrete industry, having built its first plant in 1922. This was the first operation of its kind in Texas and one of the first in this country.

Aggregates are brought in from the company's gravel plant in gondola cars and are unloaded by a Brownhoist steam locomotive-crane with a 1¼-cu.yd. clam-shell bucket of the same make. This handles the aggregates to an open storage of 9,000 cu.yd. total capacity divided into six compartments by concrete partition walls. Washed pit-run gravel, two grades of washed sand, and three grades of washed gravel are stored.

Aggregates are recovered from storage by a tun-



Cement-weighing batcher with rotary valves of the pneumatic-conveying system above.

nel-conveyor system of the type which has been rapidly increasing in popularity in recent years. The concrete tunnel is 350 ft. long, 6 ft. high, and 5 ft. wide and feeds through 35 lever-controlled clam-shell gates to the reclaiming belt-conveyor. This is a 24-in. unit 360 ft. long between centers. By combining various sizes of aggregate on this belt any desired grading of materials can be obtained. Some washed pit-run gravel is still being used for certain types of cheap concrete work. A bar grizzly supported over the tunnel conveyor under the pit-run gates removes any slight amount of oversize material and piles it on the floor on one side of the conveyor. At the end of the day this is shoveled back on the tunnel belt, which is reversed to carry this material to a waste-pile at the far end of the tunnel.

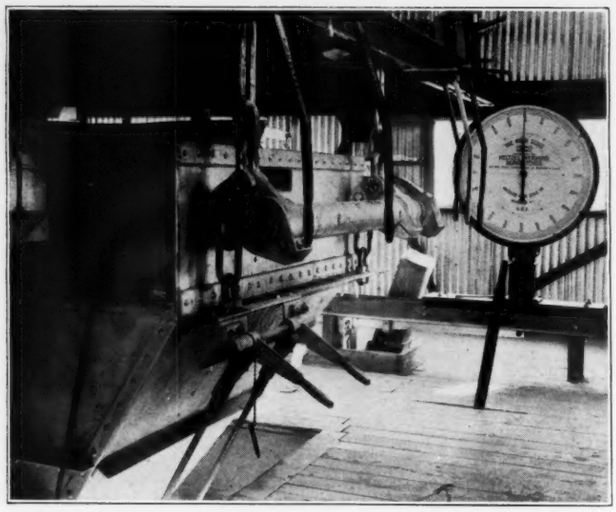
The tunnel conveyor extends a short distance beyond the mouth of the tunnel, at which point it inclines to discharge to a 24-in. inclined belt-conveyor,

Looking up the main inclined conveyor.

168 ft. long between centers, which takes the aggregate to the top of the dry-loading plant. This conveyor discharges by means of a flop-gate either to the dry plant or to a 24-in. inclined belt-conveyor, 48 ft. long between centers, to the concrete plant.

The tunnel conveyor is direct-gear-driven by a 10-hp. motor and the main inclined conveyor by a 20-hp. motor through chain and gear. The short inclined conveyor is driven near its tail pulley by a 7-hp. motor through a silent-chain drive, the entire drive mechanism being inclosed within the steel-truss conveyor support.

The dry plant consists of a 6-compartment Heltzel steel storage bin with a total capacity of 180 cu.yd. Aggregates are distributed to the various compartments by a revolving chute under the main conveyor. Each compartment discharges through a clam-shell gate into trucks for delivery. This unit



The aggregate-weighing batcher and dial scale.

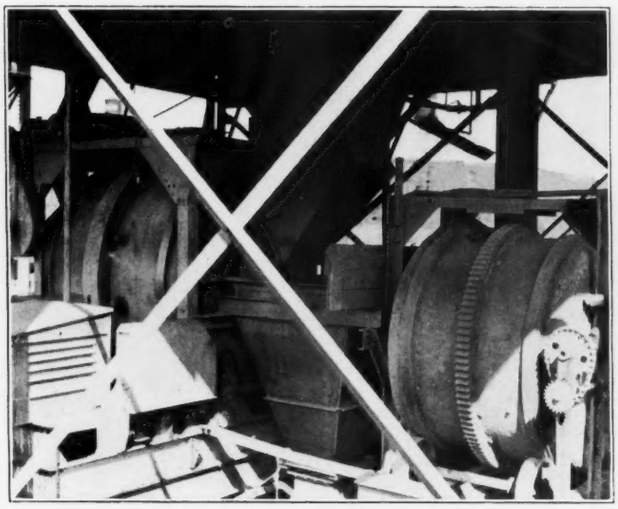
handles all city distribution of the company's gravel and sand. A truck scale will later be installed near this bin for weighing out shipments.

The conveyor to the mixing plant discharges by means of a revolving chute to any of the five compartments of the Heltzel 150-cu.yd. aggregate-storage bin over the plant. The framework of this bin is inclosed and forms the batching floor. A completely-equipped testing laboratory is maintained in a room formed by a partition at one side.

Cement is received in bulk in box-cars from two

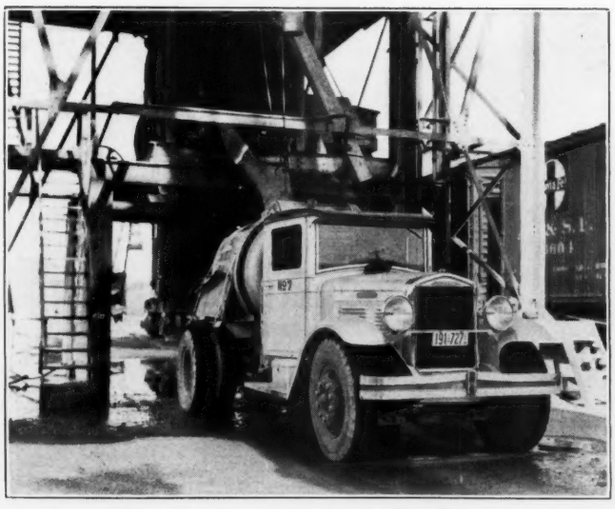
Revolving chute discharging to concrete-plant bins.

near cement plants. It is unloaded by a Link-Belt power scraper to a steel-inclosed Link-Belt chain-bucket elevator. This operates on 76-ft. centers



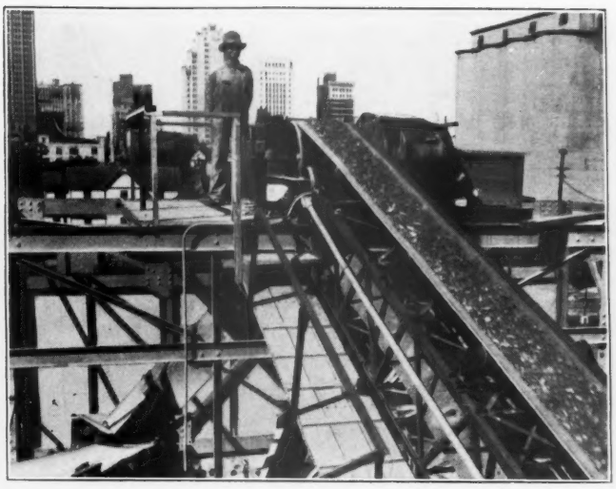
The two concrete mixers with chute between. The chute can feed either mixer or the dry-loading hopper below.

and discharges through a selective split chute to either of two 400-bbl. steel cement bins alongside the aggregate storage bins. Air jets near the bottom of each bin fluff the cement to facilitate unloading. Air for these jets is furnished by a Curtis 1-cyl. air-compressor driven by a ½-hp. motor. The scraper is driven by a 5-hp. motor and the elevator by a 10-hp. motor through chain and gear. The cement bin discharges through a Fuller-Kinyon rotary valve into a 3,000-lb. Heltzel weighing batcher equipped with a Kron dial scale. Aggre-



One of the trucks being loaded at the mixer.

gates are discharged through clam-shell gates into a 10,000-lb. weighing batch which also is equipped with a Kron dial scale. Water from the city mains is measured in a 96-gal. broken-siphon-type tank of the company's own design. A Weller Manufacturing Co. man-lift elevator to the batcher floor is used for handling sacked special cements and can also be used for regular cement in case of an emergency. This is driven by a 2½-hp. motor.

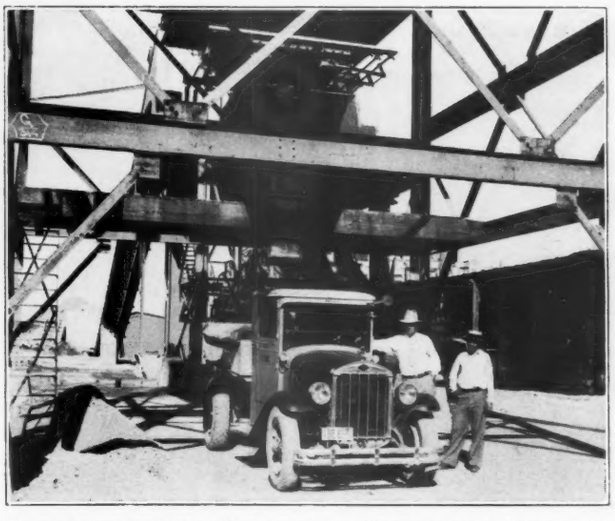


The top of the main inclined conveyor showing the drive. Conveyor to concrete plant at left.

Mixing is done in a Jaeger 2-cu.yd. drum-type mixer which discharges into the agitator trucks through a special tubular chute. This mixer is gear-driven by a 40-hp. motor. The 1-cu.yd. Ransome mixer from the old plant is mounted opposite the other mixer and the two can readily be connected when needed. The old mixer will be used for small orders when such a demand arises. A hinged chute feeding from the batchers to the large mixer can be shifted at a moment's notice to feed to the small mixer. It can also discharge to a small hopper (between the two mixers) which discharges through a clam-shell gate directly into trucks. This is used for loading dry-batched aggregates and can also be used to load the agitator trucks in case of a breakdown of the mixer, in which event the agitators would be used as mixer trucks.

Ten Jaeger 2-cu.yd. truck mixers are used as agitators for delivering the concrete. These are mounted on Indiana-Brockway 3½-ton chassis with dual-pneumatic rear tires.

The plant has a simple drainage system to take care of the water used in washing out the mixers and trucks as well as casual water. Everything



Truck being loaded at the dry plant. Supt. J. J. Randale and his assistant are standing alongside.

Another view of the plant showing locomotive crane unloading aggregate to storage.

drains to a concrete sump alongside the plant, where the silt and cement are allowed to settle out. A 16-in. pipe carries the water from this sump to a channel (under the tunnel conveyor) which feeds the city sewers. This channel also serves to carry off any seepage from the stored aggregates.

A two-story concrete-tile office building is located near the plant. On the first floor is the employees' room with lockers, showers and other conveniences. A radio in this room entertains the truck drivers while waiting for orders. The top floor is the general plant office where all orders are received. A Telautograph of the type found in department stores carries orders for concrete from this office to the batcher floor. Two copies of each order are then dropped through a chute to the driver, one for himself and one for the customer, while a third copy is kept in the office.

All the aggregate and cement storage bins and the weighing batchers were furnished by the Heltzel Steel Form & Iron Co. Belt-conveyor idlers and drives were furnished by the Barber-Greene Co. The two inclined conveyors have Barber-Greene steel truss framework and the main conveyor has a gravity belt take-up. Of the eight motors used in the plant four are General Electric sleeve-bearing motors and four are Howell roller-bearing motors.

Part of the truck fleet lined up at the plant.

Goodyear Class "C" conveyor belting is used in the tunnel, Mechanical Rubber "Marco" on the main inclined conveyor, New York Rubber Co. "Stonecove" on the short inclined conveyor, and Goodyear belting on the man-lift elevator. The Industrial Controller Co. furnished the automatic starters. Square D safety switches and Crouse-Hinds conduit are used throughout the plant, which is inclosed with Granite City corrugated sheet metal.

The main purpose in the design of this plant was to insure against delays due to breakdowns. As has previously been mentioned, the agitators can be used as mixer trucks in case the plant mixer should fail and the man-lift elevator can be used for handling sacked cement should the bulk-cement unloading and handling system give trouble. Only by the failure of one of the conveyors would the plant be incapacitated, and such a failure is highly improbable. Only six men are required to keep the

Washing one of the delivery trucks between loads.

plant operating at capacity, this number including the two men on the locomotive-crane and the cement unloader.

The main office of the Fort Worth Sand & Gravel Co. is at 1105 Fair Bldg., Fort Worth, Texas. The company's officers are: H. P. Bonner, president and general manager; J. O. Hart, vice-president; C. S. Edwards, secretary; T. E. Popplewell, treasurer and purchasing agent; and R. M. Quigley, chief engineer. I. I. Randale is plant manager. Credit for the design of this plant is due largely to Mr. Quigley and Mr. Popplewell.

CARRIED by a mile-long tramway, the stone from the mountain quarry of Basaltstein Gesellschaft is processed at a modern, efficient plant at Buchs, on the Switzerland-Austria border. An exclusive story of this operation, illustrated with especially-prepared drawings and photographs, appears on page 20.

New York Stone Producers and N. C. S. A. Exhibitors Meet October 23

Both Gatherings Held Same Day at Hotel New Yorker; 1932 Convention Discussed

By HARRY E. HOPKINS

WHILE the New York State Crushed Stone Assn. and the Manufacturers' Division of the National Crushed Stone Assn. carried on as separate entities at their monthly meeting and annual dinner at the Hotel New Yorker, New York, on Oct. 23, both bodies were in such perfect accord that one had the feeling that they might just as well have been one body to all intents and purposes. Their principal object was to make the Pittsburgh convention a success in every way. It was a big day for both, and large with purpose.

The meeting of the state association was called to order in the morning in Parlor A by President Owens. A business meeting of stone producers is in great measure a business-family affair wherein the reporter, if he is discreet and can be trusted, is allowed to sit in and listen. What he hears he forgets when he steps out, if he is wise.

Many matters of direct concern to the producers were discussed. Points about prices, inspections, highway-department conditions—plans talked over; problems presented; little rough places ironed out; new light shed. But, here are some of the happenings we are privileged to relate:

Bruce Shotton, chairman of the Manufacturers' Division, made an earnest plea for the state association's strongest coöperation in putting over the manufacturers' exhibit at Pittsburgh. And he has been promised all he asked for.

A. T. Goldbeck, director of the Bureau of Engineering of the national association, told of the great good the bureau has so far accomplished for the industry; its service to interests outside of the producers' direct operations; of the researches under way; of the necessity for closer contact and more intimate knowledge on the part of the producer of the bureau's work and purpose; of the need for further enlarging its facilities to cope with the problems that confront it. Mr. Goldbeck was frequently consulted on points coming up in the session's procedure.

Otho M. Graves (president of the national association for four successive years, isn't it?), a member of the state association, was at one minute called upon to introduce some shrinking soul whom he thought worthy of the session's attention; at another, divulging of his ripe knowledge something that would assist in untying a knotty point, and always getting the ear of his hearers.

National President Worthen addressed the association, glad to come with the memory of his visit in August to the Pennsylvania State Producers' Assn. He asked that his hearers give heed to the needs of the Bureau of Engineering; that the state association do its utmost to make the Pittsburgh convention a big success; that the Washington office be called upon more frequently, particularly when the individual producer needs assistance from the central point. President Owens assured Mr. Worthen that he had the association's support to a man.

Paul B. Reinhold, secretary of the Pennsylvania association, also was a guest. His knowledge of Pennsylvania is intimate and almost unlimited, and his remarks were highly enlightening as to his state's practice.

George E. Schaefer, twice president of the state association and for several terms its secretary, was busy every minute, either welcoming a visitor, answering questions, gathering data, or registering the members.

Sitting in at the meeting were several members of the Manufacturers' Division, for they are always warmly received at these meetings of the producers.

President Owens announced that the New York producers were invited to attend the dinner meeting of the manufacturers. Then the October meeting was adjourned.

Luncheon was served to all present in the adjoining dining-room. It was a bully lunch, from oysters to cream. Informal talks were indulged in.

The afternoon was spent in visiting places of interest in the Big City. Some shopped in the dry-goods district, others visited the national executives in their rooms at the hotel.

Manufacturers' Division Dinner

As has been intimated, the state association meeting was an informal "family" affair. But when these manufacturer chaps "pull off anything"—speaking in the vernacular of little old N'Yawk—they all pull together, and pull one's heartstrings and make his Adam's apple work an extra shift. The scene of the dinner was the ballroom of the Hotel New Yorker, situated in every way to give delight and comfort.

An orchestra discoursed everything from "Rosie O'Grady" and "East Side, West Side," to the Götterdämmerung, which you may not have whistled recently. There were ninety to a hundred present, and in the half hour before the dinner and the flashlight picture, all was as merry as the proverbial wedding bells. It was "Hello, Bruce"; "Welcome, Otho"; "Good old Sam"; "Gosh, Mike, howdy"; —coming from the stone producers as they entered the ballroom. Old caveat emptor was dead, and

Scene at the dinner of the Manufacturers' Division of the National Crushed Stone Assn.

"buyers and sellers," one and all, displayed that true camaraderie so rare in these troublous times. "This is the real 'brotherhood of man' spirit. Thank God for it!" said my fellow diner as we sat down. And we repeat it.

Bruce Shotton, chairman of the Manufacturers' Division, was toastmaster. After greeting the officers and members of the national and state associations and their member guests, he announced the purpose of the dinner—to promote the Pittsburgh convention.

National President Worthen gracefully acknowledged the welcome and then he, too, took the convention as his main topic. Now who says that Pittsburgh won't win—10 to 0?

"The national association is shoulder to shoulder with the Manufacturers' Division, and the convention and show are going to be the success they deserve," said Mr. Worthen. "Pittsburgh offers every advantage as a convention city, particularly to the East, but the East has always gone to the West cheerfully, and the West will come east equally so.

"The exhibit's value to the stone producer need hardly be dwelt upon. It offers both producer and manufacturer an equal opportunity—in the purchase of equipment; in learning the requirements of the producer. In this rather discouraging period of depression to producers, with increasing competition, a spirit of close coöperation is bound to be of mutual helpfulness."

Mr. Worthen read a telegram from E. J. Krause, of the national board of directors, expressing his inability to come to New York, "but you have my very best wishes." Regret was also expressed that Directors Wise of Texas and Doolittle of Hamilton, Ont., could not attend.

J. R. Boyd, executive secretary, was most enthusiastic over the progress of the convention plans, which are already well advanced. "The successful exhibit will be the result of thoughtful planning on the part of all concerned; not otherwise. Now, gentlemen, take back with you a complete picture of your coming exhibit and its many advantages. Think of the good contact to be had by both producers and equipment men. Send your technical men and operating men to the show. The convention program has been arranged to allow them ample time to visit and study the show.

"As to the exhibit itself, there are 95 booths, with but little choice between them. The cost of space will be less than at any of the other exhibits. Included in the cost is free cartage and delivery to booths, power hook-ups, and other accommodations. Reduced rates are yours, including the Road Show, the sand-and-gravel and the crushed-stone conventions. The hotel facilities are of the best. Everything will be done to give you satisfactory service."

Otho M. Graves, always heartily received when he rises to speak, in his remarks went back to the beginning of the Manufacturers' Division in 1923, when, in a small room in the Hotel La Salle, in Chicago, seven earnest men of the industry met to form the division. They were Messrs. Farrell, Andrews, Shotton, Garber, Greensfelder, Johnson, and Rockwood.

"Five of those men are here with us to-night. They worked early and late, and over exceedingly rough places, trusting to God to come out right. To-day the division lies deep in our hearts for the fine service rendered; for the value it has been to us; for the high character of its members."

John Rice—he needs no introduction—was an honored guest at the speakers' table. After a warm welcome he said: "Again it is a great pleasure to meet the Manufacturers' Division members. I came to say hello, and good-by." Mr. Rice has missed but one meeting of the division since it was formed.

A. T. Goldbeck, director of the Bureau of Engineering, in his remarks declared that the attendance augured well for the division's solidity. "My one message is: Better things are coming soon."

W. L. Forborg said that "out of what has been done by us all, we have created something out of nothing—an entity through contact by association and division. An intangible thing ties us together. Our identities and activities find level ground. Our common understanding is our achievement."

(Continued on page 56)

The roving dunes on the shore of Lake Michigan near Michigan City yield quantities of core, structural and glass sands.

Limestone of Primary Importance Among Indiana's Nonmetallic Minerals

Quarried as Dimension Stone and Widely Used for Cement, Lime and Road Building

By WILLIAM N. LOGAN
State Geologist

THE nonmetallic minerals of Indiana include a large number of raw materials which may pass through a number of preparatory, milling or manufacturing processes. These include sand and gravel used for structural purposes; sands used in the manufacture of glass; sands used for abrasives; sands used in the manufacture of silica brick; sands, clays and silts used for foundry purposes; glacial boulders used for structural purposes; sands, quartzites and cherts used for filtering purposes; limestone used for building purposes, as concrete aggregates, in the manufacture of lime for structural and agricultural purposes, and in the manufacture of natural and Portland cements. The sandstones of Indiana are used for building construction and other structures, and in the manufacture of glass; clays and shales are used in the manufacture of brick and cement; shale and limestone are used in the manufacture of mineral wool; and sandstones for abrasives and structural purposes.

Sand and Gravel

Sand and gravel for structural and manufacturing purposes are widely distributed in Indiana. All that portion of the state which has been glaciated contains deposits of sand and gravel. Even in the driftless area there are deposits which are useful to its inhabitants. Some of the deposits of this area are derived from the glaciated area by the actions of major streams which carry materials from the glaciated area, while some are residual materials derived from the weathering of rocks within the non-glaciated area. There are also some wind-transported sands within the non-glaciated area. However, the more extensive sand-and-gravel deposits are found in the glaciated area and along the courses of major streams which have their sources in the glaciated area.

Origin.—The sand and gravel of Indiana are largely of glacial origin. Some of these materials were deposited in moraines where there is little evidence of the sorting action of waters. In other places where, with the melting of the ice large quantities of sand and gravel were swept outward in front of the retreating ice, the sorting of the materials was more thorough. Stream valleys trenched during or following the glacial period contain large quantities of sand and gravel from which the silt and clay have been removed. Winds blowing across the flood plains of such streams have carried sands to the valley walls there to form dune areas.

The physical properties to be considered in connection with sand-and-gravel deposits will depend upon the purposes for which they are intended. In all uses to which they may be subjected the size of the particles is an important property.

Size.—The large rock-masses which are found in the glacial drift were transported by the ice as it moved over the surface of the state. Some of these rock-masses were plucked from the surface rocks during the first glacial invasion. But many of the large rocks in the glacial drift were brought from points well beyond the northern limits of the United States. Rock-masses transported from such distant points may be six or more feet in diameter. Rock-masses of the earliest ice invasion have, in many places, undergone marked disintegration since they were deposited and are no longer of large size. In the glacial drift occur rocks which vary in size from large boulders to the finest sand grains.

Composition.—As would be expected in materials derived from many sources the composition of glacially-derived rocks varies as the composition of rocks from which they were derived. Some of the rocks are composed wholly of silica, others contain mica, feldspar and other minerals and some glacial rocks were derived from pure limestones. In many places glacial rocks are deposited as a heterogeneous mixture of limestones, shales, sandstones, and crystalline rocks.

Uses.—The sands of Indiana have a variety of uses and serve many purposes within and without the borders of the state. They are being used for structural purposes, in the manufacture of glass, as abrasives, for engine sand, in foundry sands, in the sawing and polishing of limestones and for many other purposes.

Gravels are being used for the surfacing of roads, for reinforced concrete, in cement and bituminous pavements, in acid towers, for filters and other purposes.

Production Methods.—One of the first steps in the production of sand and gravel is the removal of the overburden of silt, loam or clay which in many places overlies the deposits. If located near a stream the overburden may be removed by hydraulicking. If water is not available the overburden may be removed by the use of power-shovels, drag-lines and clam-shells.

Glass Sands

Mechanical Composition.—The silica used in the manufacture of glass in Indiana is derived from sands and sandstones. The natural mechanical condition of many of the glass sands in Indiana is satisfactory. In these the greater part of the grains fall between the necessary mesh limits of from 20 meshes to the inch to 120 meshes to the inch. The shape of the grains varies from well-rounded, through sub-angular, to angular. Some of the sands can be used as they are taken from the pit; others must be washed for the removal of fine particles and iron compounds.

Chemical Composition.—Sands used for making glass necessarily contain a high percentage of silica, and the amount of this mineral rarely falls below 98 per cent. One of the best sands used for making glass in the state contains 99.99 per cent. of silica, .008 per cent. of alumina, and only a trace of oxide of iron and no lime.

Distribution.—One of the largest areas containing glass sand lies in the Lake Michigan area in Lake, Porter and Laporte Counties which form the southern shore line of the lake. In this area dunes of pure white sand of large size are interesting features of the landscape. The sands which form the dunes were deposited in glacial lakes and were later heaped into dunes by the prevailing winds. The dune area, bordering Lake Michigan, lies principally between Gary and Michigan City. The recent dune and beach area is rarely more than one mile in width but the dune and beach area of glacial Lake Chicago is more than three miles in width. The dunes attain a height of as much as 190 ft. The bases of the higher dunes cover areas of from one hundred to two hundred acres. A large dune area which lies south of the Kankakee River covers an area of more than 2,000 sq. mi.

Mansfield Sandstone.—The basal division of the Pennsylvanian group in Indiana contains a quartzose sandstone which has been used in a number of places in the state for glass making. In places this sandstone attains a thickness of more than 200 ft. The outcrop extends from the Ohio River, near Cannelton, to Attica in Fountain County. Outliers of the formation are also found east of the line joining these two points. Glass sands have been obtained from a sandstone horizon above No. III coal in Clay and other counties. At Coxville in Parke County a mound-like deposit of glass sand occurs below the horizon of the coal. The sand from this deposit was

Glass-sand deposit at Skellton Cliffs in Gibson County.

used in the manufacture of glass for many years. The Mansfield sandstone from which glass sands are obtained in many parts of Indiana has a silica content of 99.79 per cent. with only .237 per cent. of alumina and only .024 per cent. of iron oxide. These results were obtained from the average of four samples. The glass sand obtained at Attica in Fountain County contains 98.84 per cent. of silica, .38 per cent of alumina, .10 per cent of iron oxide and .03 per cent of magnesia. The prepared glass

sand which is obtained from the Mansfield sandstone near Loogootee contains 97.78 per cent. of silica, 1.13 per cent. of alumina, .10 per cent. of ferric oxide and .06 per cent. of lime.

Production Methods.—Dune sand is excavated by the use of power-shovels, drag-lines, derricks, or pumps. Sandstones which are used in glass making are drilled, blasted, crushed, washed and screened.

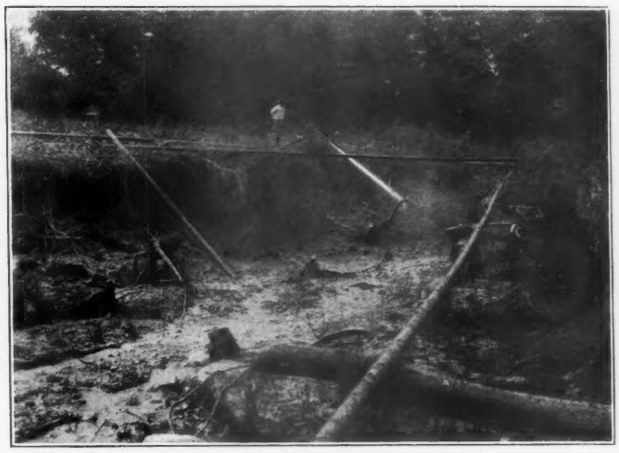
Foundry Sands

Sands or mixture of sand, silt and clay are used in foundries for the making of molds in which metals are cast, or in making cores which are intended to fill the open spaces in castings. The sands used in the making of cores are of coarse texture and composed of grains of medium or large size. These grains are often bound together by the use of an artificial binder. The sands used for making molds are of finer texture and are generally held together by a natural bond of clay. In the making of small castings molding sands of very fine texture are used. The sands used in the manufacture of castings of large size are frequently of coarse texture. Molds used in the manufacture of some castings may be faced with graphite or other refractory substances. The chemical and physical properties of foundry sands must be considered in determining the value of sands for foundry use. The physical properties which have value in determining the usefulness of the sand for foundry purposes are refractoriness, cohesiveness, permeability, and durability.

Deposit of glacial sand and gravel in Owen County.

Refractoriness.—Sands which contain substances which are easily fused at low temperatures can not be used in the making of molds. Foundry sands sometimes contain minerals or substance which will either fuse or be destroyed at the temperature of molten metal. Among such substances is calcium carbonate which may be converted into quicklime and destroy the form of the mold. Some iron compounds contain water of crystallization which may be driven off by the heat of the metal. Other molding sands may contain carbon or hydrocarbons which are easily destroyed by heat when the metal is poured into them.

Cohesiveness.—In order that a mold may assume its proper shape and that it may retain that shape until casting is completed, the individual grains of the foundry sand must be held together by some sort of bonding material. The substance which serves this purpose best in natural molding sands is clay. It bonds the sand grains together and is relatively infusible. In synthetically-prepared molding sands clay may be added to bond the quartz grains.



Hydraulicking residual-clay overburden in the dimension-limestone district.

Fineness of Grain.—The mechanical analysis or the separation of the constituent particles of a foundry sand into divisions of a certain uniformity of size is an aid to the determination of the usefulness of foundry sands for specific purposes. A mechanical analysis of a foundry sand may be made by passing a given amount of the sand through a set of sieves of known mesh, computing the amount retained on each sieve and comparing that amount with the total amount of sand used for the test. A comparative particle separation can be made by the use of a vibrator which will keep the particles of sand in suspension until they settle in the order of their specific gravities. The silt particles will settle as soon as the agitation ceases but the clay particles will remain in suspension for some time after the vibrator ceases action. Results may be obtained more rapidly by this method and the separation into sand, silt and clay is distinct.

Permeability.—Sands used for foundry purposes must be porous enough to allow the passage of gases through the walls of the mold. The presence of such gases may arise from a number of sources. They may be from the cushion of air on the inner wall of the mold or they may be from air within the pores of the mold. Gases may be created within the walls of the mold by the influence of heat of the molten metal on moisture, hydrous minerals or colloidal substances. The mold must be permeable enough to carry off such gases or the walls of the mold may be disrupted and the metal may penetrate the mold. By the use of an aspirator, the permeability of samples of molding sand may be tested. The air may be drawn or forced through the samples of sand to be tested.

Durability.—Foundry sands to be used economically should possess properties which will allow them to be used again and again. Foundry sands differ greatly in durability. Some sands may be used so long as there is enough sand remaining to complete the mold. Others are easily renewed by

adding a small amount of fresh sand. Some have their usefulness destroyed by being used only a few times. Careful experimental work in the foundry is necessary to determine the length of life and the possibilities of renewal of a given sand.

Molding Sands.—Foundry sands used in the manufacture of molds have different compositions and different physical properties from those sands used in the formation of cores. Molding sands contain a natural binder which is usually silt or clay, although other substances may contribute to at least a small degree. Good molding sands possess a proper balance between sand and bond. Too much silt or clay may fill all the space between the sand grains and thus prevent the escape of gases. Coarse sands will require more bond than fine sand.

Core Sands.—Core sands are of a coarser texture than molding sands. In addition to the small amount of natural bond which may be present they often require the application of an artificial binder. This binder must hold the particles of sand together without completely filling the interstices which are the safety valves for the escape of gases. When the core has been shaped the binder must harden sufficiently to form a coherent body which can easily be separated from the casting. Core sands should be selected to meet the requirements of the metal to be cast. The materials used should be thoroughly mixed and tempered.

Mold-Facing.—When a mold has been completed it may be faced by the use of pulverized minerals. The substances which are used include graphite, pulverized coal (sea coal), talc, fire clay, asphalt, resin and other substances. Molasses water and kerosene are used for sponging the surface of some molds after they have been completed.

Geological Distribution.—Many formations in Indiana produce sands which are suitable for foundry purposes when the rocks of these formations are sufficiently disintegrated under the influence of weathering. These residual materials are in some places naturally blended under the action of running water but as a rule preparatory methods must be used before such deposits can be utilized. The larger part of the foundry sand of the state is obtained from Pleistocene deposits but some of them are of pre-Pleistocene and of post-Pleistocene age.

Geographical Distribution.—Foundry sands are widely distributed in Indiana. There are few, if any, counties which do not contain some materials which are suitable for foundry purposes. In many of the counties are natural deposits which may be used as they are taken from the pit. The counties in which commercial quantities have been produced include: Allen, Bartholomew, Cass, Clark, Clay, Elkhart, Gibson, Grant, Harrison, Henry, Jackson, Jefferson, Knox, Lagrange, Lake, Laporte, Marion, Morgan, Monroe, Newton, Owen, Porter, Starke, St. Joseph, Spencer, Steuben, Sullivan, Tippecanoe, Vanderburgh, Vermillion and Vigo.

Table I. RESULTS OF TESTS ON INDIANA FOUNDRY SANDS

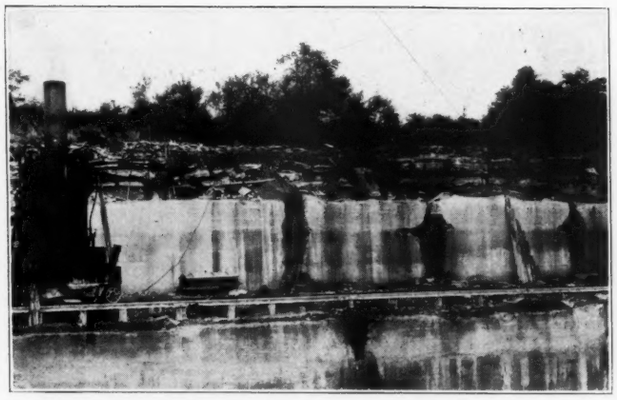
Where Produced	Screen Analysis										Water (per cent.)	Bond Strength	Permeability
	On 20	On 40	On 70	On 100	On 140	On 200	On 270	Through 270	Clay	Total			
Clark Co. Jeffersonville		.06	.12	.18	.57	1.97	4.96	84.30	7.84	100.00	4.4	134	5.06
											5.9	143	5.76
											7.1	156	5.65
											8.0	159	5.50
Gibson Co. Patoka	4	10.6	30.0	20.4	8.8	2.4	1.3	19.6	6.5	100.00	5.2	264	84.0
											7.0	302	113.0
											8.8	214	76.0
Perry Co. Troy		2.3	22.0	13.8	5.2	2.3	1.0	38.6	14.8	100.00	5.9	230	5.1
											7.1	250	5.5
											8.0	254	14.0
											9.5	268	13.9
Perry Co. Troy		.1	.2	.2	.2	.3	.4	72.4	26.2	100.00	5.9	277	2.6
											7.2	307	5.7
											7.7	290	2.8
											9.1	274	2.4
Perry Co. Troy		5.6	36.1	11.8	3.5	1.2	.7	22.0	19.1	100.00	6.7	250	12.8
											7.1	319	23.0
											8.0	255	52.0
											9.2	250	37.8
Perry Co. Troy		4.5	43.2	23.6	6.2	2.1	.7	5.3	14.4	100.00	5.3	327	303.0
											6.0	342	116.0
											7.1	366	117.0
											9.8	305	125.0
Spencer Co. Rockport			.4	.4	.6	.6	2.4	82.8	12.8	100.00	3.9	213	3.62
											5.8	309	5.85
											7.9	243	3.51
											9.5	238	3.44
Spencer Co. Rockport			3.0	7.4	11.0	4.2	3.7	65.1	5.6	100.00	4.0	135	3.58
											5.7	152	4.16
											6.6	159	4.85
											7.7	173	5.22
											10.2	176	4.18
Spencer Co. Rockport		.2	3.2	8.6	11.4	4.4	3.0	62.4	6.8	100.00	4.0	170	3.9
											5.1	190	4.7
											7.6	197	6.8
											9.5	209	10.0
Spencer Co. Rockport			1.8	4.4	6.0	2.6	6.4	71.6	7.2	100.00	3.9	169	3.48
											6.6	238	7.12
											8.1	273	6.25
Spencer Co. Rockport			.4	1.0	3.0	2.2	5.4	79.2	8.8	100.00	4.4	173	4.25
											6.1	228	7.14
											8.4	227	3.52
Spencer Co. Rockport				.2	.2	5.0	3.0	72.0	19.6	100.00	4.3	193	1.33
											7.0	197	1.67
											8.6	270	2.08
											10.4	244	1.60

Loading limestone columns onto flat-cars for shipment.

Building Stone

Ordovician Limestones.—The limestone beds of Ordovician age in Indiana are generally thin and irregularly bedded. They have been used to a limited extent for structural purposes and in the manufacture of lime. Limestone of this period has been quarried in Wayne, Fayette, Union, Franklin, Dearborn, Ripley, Ohio, Switzerland, Jefferson and Clark Counties.

Silurian Limestones.—Limestones of the Silurian



At left, a channeling machine at work in a limestone quarry.

period are exposed along the courses of the larger streams in the northeastern part of the state but are found to a greater extent in the southeastern portion where the glacial drift has been more thoroughly removed. The unweathered stone is often blue in color but changes on exposure to white. It is often thinly-bedded, the stone from such beds being used for flagging, gutters, and curbing. The limestone has also been used for structural purposes in bridges and in buildings. It has been quarried at Anderson, Alexandria, Bluffton, Buena Vista, Delphi, Eaton, Greensburg, Harper, Holton, Huntington, Kokomo, Laurel, Longwood, Marion, Markle, Montpelier, Newpoint, Osgood, Peru, Sardina, St. Paul and Westport.

Devonian Limestones.—Limestones of this period have been used for roads, rubble, curbing, and flagging. For local structural purposes they have been used in the construction of bridges and buildings. They have been used also in the manufacture of natural and Portland cement. They have been quarried at Decatur, Logansport, Monticello, Rensselaer, North Vernon, Speed, and other places.

Mississippian Limestones.—The limestones of the Mississippian age in Indiana contain large quantities of building materials of excellent quality. The divisions of the Mississippian which contain limestones are the Harrodsburg, the Salem, the Mitchell and the Chester. All these divisions contain limestones which have been used at least locally for structural purposes.

The limestone from the Salem formation has had the most extensive use for building purposes. Its excellent qualities have been widely recognized in the United States and in other countries. The building stone of this formation is a medium fine-grained, even-textured rock composed of shells and the fragments of shells which are united by a calcium-carbonate cement. Its color is buff or gray and its porosity is low. The tensile strength and the crushing strength are sufficiently high to give an excellent factor of safety.

The outcrop belt of the Salem limestone extends from Putnam County southward to the Ohio River in Harrison County. The main quarrying district lies in Monroe County and in Lawrence County. Quarries in Monroe County are located near Stinesville, Elletsville, Bloomington, Hunter Valley, Sanders, Smithville, Victor, Clear Creek, and Harrodsburg. In Lawrence County quarries are located at Oolitic, at Bedford, Dark Hollow, Eureka, Blue Hole, Needmore, Stonington, Peerless and Heltonville.

Composition.—The limestone from the Salem formation in Indiana which is sold under the name of Indiana limestone and has been called "Indiana oölitic limestone" is a limestone composed essentially of calcium carbonate. The amount of calcium carbonate in the limestone used for building purposes rarely falls below 98 per cent. and ranges even higher than 99 per cent. in some samples. A small amount of magnesium carbonate is present, usually not to exceed three-fourths of one per cent. Small amounts of iron, silica, aluminium, carbon, potassium, sodium, sulphur, and phosphorous are present in some samples. Impurities of the kind mentioned rarely occur in quantities sufficient to cause even staining of the surface when it occurs and is quarried under normal conditions. The color of the Indiana limestone is either buff or gray. The buff stone lies above the water table in the quarry and the gray stone lies below the water table. Indiana limestone is composed of small shells, the fragments of shells, and the remains of other forms of marine life. These shells and fragments constitute the grain of the rock. Some of the spherical bodies have concentric layers of calcium carbonate around them. These and the spherical shells were responsible for the term "oölitic" which has been applied to the Indiana limestone.

Porosity.—The property of having pores which are minute spaces not filled with mineral matter is possessed by most rocks. In the Indiana limestone both visible (or macroscopic) and invisible (or microscopic) pores exist. The percentage of pore space varies with the size, shape, and arrangement of the grains. The porosity also varies with the amount of cementation which has taken place since the grains were deposited. Fineness of grain combined with a high degree of cementation will tend to produce a stone of high density and of low porosity. Porosity decreases the weight of the limestone and excessive porosity may decrease its strength.

Compressive Strength.—Tests which have been made on samples of Indiana limestone by the United

On the floor of a quarry. Note derricks, channelers and drilling operations.

States Bureau of Standards exhibit a range in crushing strength from 6,000 lb. per sq. in. to 10,000 lb. per sq. in. The cross-breaking strength is measured in terms of the modulus of rupture, which is the weight necessary to break a bar of 1-in. cross-section when resting on supports 1 in. apart, the weight being applied at the middle of the bar's upper surface. The weight required to produce rupture in the Indiana limestone varies from 800 lb. to 1,300 lb.

Weight.—The weight per cubic foot of Indiana limestone varies with the specific gravity of the stone and the percentage of pore space which it contains. The higher the percentage of porosity the less the weight per cubic foot of dry stone. The weight per cubic foot of samples of the limestone tested by the United States Bureau of Standards ranges from 136 lb. per cu. ft. to 152 lb. per cu. ft. The weight of a cubic foot of pure calcite is 168.8 lb. per cu. ft. The difference between this weight and the weight of the heaviest sample of the limestone is due to pore spaces in the limestone and to the presence of other mineral substances which are lighter than calcite.

Structural Features.—One of the most outstanding features of Indiana limestone is its massive character or absence, except very locally, of bedding planes. This feature of the limestone has made it possible for the quarryman to obtain blocks of large size and columns of great height. Bedding planes are present and are highly characteristic of both the overlying St. Louis limestone and of the underlying Harrodsburg limestone.

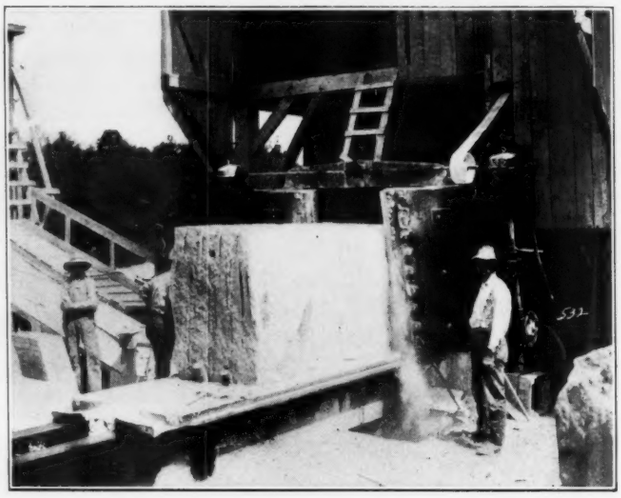
Other structural features include cross laminations, calcite veins, drys, joints, mud seams, stylolites, and unconformities.

Quarrying Methods.—Since the largest part of the limestone used for building stone is quarried in the non-glaciated portion of Indiana the overburden near the outcrop of the limestone usually consists of a residual clay. Where clay alone constitutes the overburden it may be removed by hydraulicking. Water may be pumped from streams and the proper pressure for hydraulicking obtained by the use of stand-pipes placed on high lands above the quarry level. After the quarry has reached a depth below the level of ground-water, the water which collects in quarry holes may be used for stripping purposes.

At points farther from the outcrop layers of undesirable stone may intervene between the stone and the overburden. Such layers of rock belong to an over-lying formation and are not desirable for building purposes. They must be removed before quarrying operations can be carried on. Thin layers of such stone may be broken with sledges and removed from the quarry site by the use of drag-scrapers, wagons or trucks. Material of this kind is frequently loaded on cars which are moved on gravity slopes to abandoned quarry holes into which it is thrown.

As the distance from the outcrop of the building stone increases, there is usually an increase in the thickness of rock overlying the stone. In order economically to remove such rock covering it is necessary to drill holes and use light charges of explosives to break up the rock so that it can be loaded on cars either by hand or by the use of power shovels.

When the overburden has been removed and any disintegrated rock which may be present on the upper surface of the building stone has been taken off, channeling machines are placed on the surface of the stone to be quarried. The channelling machines move over the surface of the exposed rock and cut it into blocks. The size of the blocks will depend upon the desired dimensions of the objects



Scabbling machine removing rough surfaces from a block of Indiana limestone.

to be obtained from them. Blocks 12 ft. long, 10 ft. high and 6 ft. thick are often produced. Such blocks are cut into smaller sizes at the mill. In some quarries it is possible to obtain blocks of large dimensions. Blocks which were 100 ft. in length and of a diameter of more than 25 ft. have been obtained. Blocks of such extreme size are used in the turning of columns for building fronts.

After the key block has been removed from the channelled floor the succeeding blocks are removed by drilling and by "feathering." Derricks are used for lifting the blocks from the quarry. Channellers and derricks are supplied with either steam or electric power.

Milling.—The limestone blocks are usually transported to the mill on railroad flat cars. At the mill they may be stacked in the yard or they may be lifted from the cars by the use of traveling cranes which distribute the blocks to the saws. The saws used are gangs which are composed of steel blades to the cutting edge of which sand is carried by the flow of water. These gang saws cut the stone blocks into slabs of various thicknesses. Another type of saw used for cutting stone is the circular steel saw which has diamonds set in the edge of the blade to form the cutting teeth. These saws are used in the preparation of dimensional blocks. Some of the blocks are planed, others are turned on the lathe, others are cut by drills and carving tools.

The planer is used for smoothing the surface of the stone as it passes under it on the traveling table.

Sandstones

Indiana contains some sandstones which have been used for structural purposes. The use of such sandstones has been largely for local purposes. Sandstones which have been used for building purposes include the Pendleton sandstone of Devonian age. Sandstones from the Mississippian formation have also been used. The Borden series and the Chester series have contributed for local uses. Sandstones of the Chester include the Mooretown, the Sample, the Elwren, the Cypress, the Hardinsburg, and the Tar Springs. A sandstone at the base of the Pennsylvania series of rocks has been quarried and used for building purposes. This sandstone is called the Mansfield. It has been quarried at Mansfield, Attica, Fern, St. Minrad, and other places.

Abrasives

Many rocks and minerals are used for abrasive purposes. Some are used for grinding, some for sawing and others for polishing. Sands are used in the limestone quarrying district in the sawing of blocks of stone into slabs. Quartz and chert pebbles are used for grinding.

Rocks suitable for the manufacture of abrasives occur in many parts of Indiana. Thinly-bedded sandstones of the Chester division of the Mississippian have been used for the manufacture of scythestones, whetstones, and oil stones. Thinly-bedded sandstones of the basal Pennsylvanian division have been used for similar purposes.

Cement Materials

The raw materials for the manufacture of cement are widely distributed in Indiana. The formations which contain suitable materials range in age from the Ordovician period to the Pleistocene epoch

View in a mill at Bedford showing the carved and planed blocks ready for shipment.

of the Quaternary period. In most localities where suitable raw materials exist they are accessible to favorable plant sites.

Devonian limestones are used in Indiana in the manufacture of cement. Natural cement is manufactured to a limited extent from the limestones. Devonian limestone and Borden shale are used in the manufacture of Portland cement.

Mississippian limestones and shales which are suitable for the manufacture of cement are abundant and are exposed over a large area in the southern part of the state. Raw materials of Mississippian age are being used at Mitchell and at Limedale.

Calcium-carbonate drip formations formed by solution of limestone in Marengo Cave.

Pleistocene clays and wares are being used in the manufacture of Portland cement by the wet process at Stroh in Lagrange County.

Furnace slag and limestone are used in the manufacture of Portland cement by the dry process at Buffington.

Location of Plants.—The Lehigh Portland Cement Co. operates a plant for the manufacture of Portland cement at Mitchell. The Lone Star Cement Co. Indiana, Inc., operates a wet-process plant at Limedale.

The Louisville Cement Co. operates a plant for the manufacture of natural and Portland cement at Speed, using the dry process. The Universal Atlas Cement Co. operates a plant for the manufacture of Portland cement at Buffington, Indiana, using the dry process. The Wabash Portland Cement Co. operates a wet-process plant at Stroh in Lagrange County.

Road Materials

Indiana possesses an abundant supply of good road materials. Such materials consist of limestones suitable for the manufacture of crushed stone and of glacial, lacustrine and fluviatile sands and gravels. Producers of crushed limestone and of sand and gravel are to be found in all parts of the state.

In the southeastern part of Indiana beds of limestone of the older geological periods—the Ordovician, Silurian and Devonian—reach the surface and are available for the production of crushed stone which may be used in the building of macadam roads and as aggregate in concrete and asphaltic types. Glacial and fluviatile gravels are present along the major stream courses.

The Mississippian formations contain beds of limestone which are suitable for the manufacture of crushed stone. The Borden formation contains some lenses of limestone which are suitable for the manufacture of crushed stone. A few outcrops of such stone occur in each county of the Borden outcrop area. In the northern portion of the state the outcrop area is covered very largely by glacial drift.

The Harrodsburg limestone which overlies the Borden is a stone which has a wide use for the manufacture of crushed stone for concrete and for macadam. It is quarried in Harrison, Floyd, Washington, Jackson, Lawrence, Monroe, Owen, Morgan and Putnam Counties.

The Mitchell limestone which lies above the Salem formation is also used to a large extent in the manufacture of crushed stone for macadam and concrete. It outcrops in the same general area as the Harrodsburg.

The Chester limestones which lie above the Mitchell limestones contain beds suitable for the

A whetstone quarry in Orange County. The thinly-bedded sandstone is Pennsylvanian.

manufacture of crushed stone. These are present in an area southwest of the Mitchell outcrop belt.

The formations of Pennsylvanian age which overlie the Chester rocks in the southwestern part of Indiana contain beds of limestone which can be used locally for the manufacture of crushed stone for concrete and road surfacing. Such limestones are often not continuous over large areas.

Lime

Limestones which are adapted to the manufacture of lime are found in many parts of Indiana. In the early days of the state's history lime was manufactured in small field kilns and used for local purposes only. Transportation facilities have increased and at the present time large quantities of lime are manufactured in only a small number of plants of large capacity.

Limestones of Ordovician, Silurian, and Devonian age have been used in the manufacture of lime in the southeastern part of Indiana. Silurian limestones have been used also in the northern part of the state in the manufacture of lime.

Mississippian limestones have been used in the southern part of Indiana in the manufacture of lime. Limestones of the Harrodsburg, Salem and Mitchell formations are adapted to the manufacture of lime. The Harrodsburg limestone contains only a small amount of magnesia, usually less than 3 per cent. The Salem limestone produces a high-calcium which often contains only a trace of magnesia. The Mitchell limestone varies somewhat in the amount of magnesia in various horizons but it usually produces a high-calcium lime with from a trace to a maximum of 7 per cent. of magnesia.

Lime produced in Indiana is used for plaster, for chemical purposes, in tanning, in sugar refining, in glass making, as agricultural lime, and in other ways.

Location of Plants.—At Salem the Hoosier Lime Co. operates five shaft kilns in the manufacture of burned lime. The Salem Lime & Stone Co. produces lime and crushed stone.

The Kelley Island Lime & Transport Co. operates ten shaft kilns at Huntington, producing burned lime, hydrated lime, and ground lime. The Indiana Limestone Co. operates a lime plant at Bedford. The plant has seven shafts kilns. The Lehigh Lime Co. operates eighteen shaft kilns near Mitchell.

The Logansport Stone & Lime Co. of Huntington has a plant at Keeport where six rotary kilns are operated. The Louisville Cement Co. operates a lime plant at Milltown. Five shaft kilns produce burned lime and hydrated lime.

The Indiana Quarries Co. at Bedford produces ground limestone for agricultural purposes and for glass making. The Utica Lime Co. of Sellersburg and the Railroaders' Lime Co. of Corydon are producers of limestone products.

Quarry Accidents in 1930 Lowest in History of Industry

Reports received by the United States Bureau of Mines, Washington, D. C., from companies operating in 1930 revealed a better safety record than the quarrying industry has ever known before. In no previous year has the combined number of deaths and injuries from accidents been as low, in proportion to the number of men employed, as it was in 1930. Apparently lower rates for 1911 to 1913, during the first years of accident-reporting by quarries, reflect incompleteness of data, particularly as regards very minor injuries, rather than genuinely lower accident rates. The death rate during the year, which was 1.53 per 1,000 workers, was 7 per cent. lower than the previous year's rate of 1.65, and lower than that of any other year except 1928, when the rate was 1.46. The injury rate, which indicated 108 injuries among each 1,000 employees, as compared with 128 in 1929, was lower than the corresponding rate for any year since complete records of injuries became available.

A total of 80,633 employees at quarries was reported to the Bureau of Mines by operating companies. This was a reduction of 6 per cent. from the number employed in 1929. The man-days of labor performed was 20,559,372, or 10 per cent. less than in 1929, and the average number of working days per man was 255, as compared with 268 in the preceding year. Accidents resulted in 105 deaths and 7,417 injuries; the corresponding record for the previous year being 126 deaths and 9,810 injuries. Reported injuries include those which result in disability for more than the remainder of the day on which the accident occurred.

Eastern Producer Adds Another Unit to Extensive Lime Operations

The quarry which produces stone for the Annville operations.

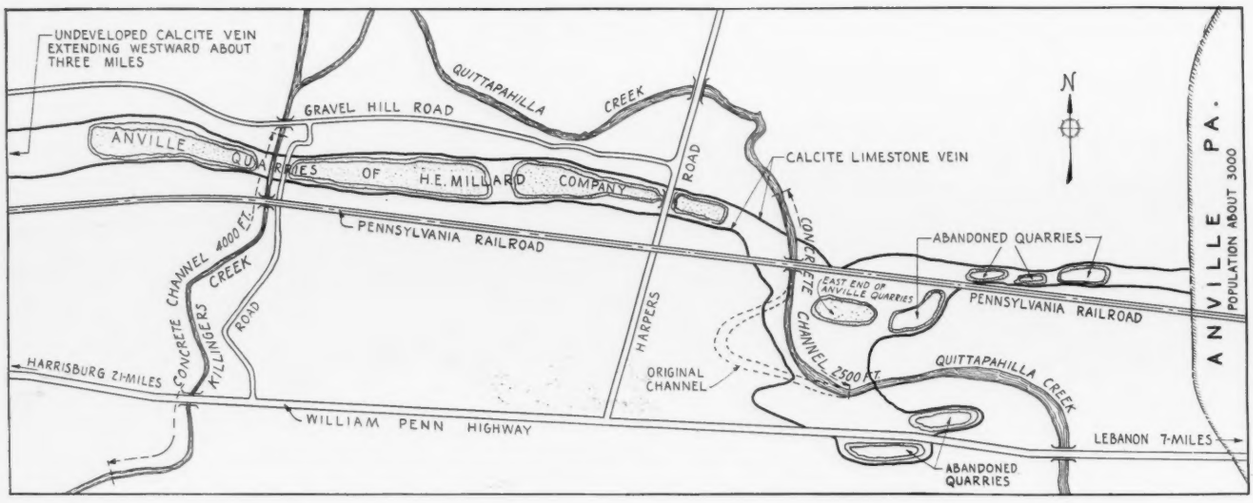
H. E. Millard Plants in Pennsylvania Also Produce Wide Variety of Stone

FINAL improvements have been completed in the lime plant purchased about two years ago by H. E. Millard of Annville, Pa. This plant is the latest addition to an extensive operation of limestone production started in the early days of the industry. A vein of high-calcium limestone had been worked in several small quarries down to water level and practically abandoned in 1900 when H. E. Millard joined his father, J. B. Millard, in operating a quarry on the latter's farm near Annville. One small crusher was used to produce fluxing-stone for North Lebanon furnaces producing pig iron, also the Reading Iron Co., of Reading, Pa.; Temple Iron Co., Temple, Pa.; and Robesonia Iron Co., Robesonia, Pa. About 1903 H. E. Millard bought a half share in the business and production was increased considerably. By 1905 the quarry was being worked below water level and great difficulties ensued. Several years later they were pumping water at the rate of 25,000 gal. per min.

The plant on the edge of the quarry at Annville.

Another view of the Annville operations.

A fair-sized creek ran through the locality and it had a small branch near. While it was probable that their water was mostly seepage from this creek, it was not a certainty, as positive proof could not be secured at that time. This stream later be-



General lay-out of the Annville, Pa., quarries of the Millard company.

came tainted from factory waste waters and it was immediately noticed that seepage water in the quarry was affected in the same way, at the same time, and to the same extent. While this definite knowledge was a great advance in the water problem, it still was impossible to locate the fault through which the water drained.

H. E. Millard has always been a great sportsman, a lover of horses, and a faithful follower of rod and gun. Had it been otherwise, the great quarrying operations shown on these pages might never have been carried out, for it was in hunting rabbits that Mr. Millard, attracted by a strange subterranean gurgling as of large quantities of water coursing through irregular stony passages—truly an unusual sound in these quiet hills—discovered the source of all his troubles with water from the creek. This

Primary-crusher building and incline to the Annville plant.

creek bed had been examined carefully all around the quarry, but it was at a point about half a mile or more away on a flour-mill property that the place was found. With the foresight and business ability that have distinguished him since early years, Mr. Millard reported the conditions to his father, and the mill property was purchased for a reasonable price at once.

How determined to carry out their objective must these men have been to let no obstruction turn them back. Even after sand-bagging and every other conceivable method failed to stop the seepage of water from this creek Mr. Millard did not give up. He was not satisfied to work the stringy edges of the vein left above the water line. Some of the best lime rock in the country was there, just a few more feet down. So he simply cased the stream in concrete. Quite simple, and a sure solution of the problem. What of the digging in slimy clay, the barriers that broke away and flooded the work, the difficult straightening of the twists and turns that nature prescribes for creeks. So now you may see the quiet inoffensive stream flowing smoothly along its concrete trench with flat concrete bottom and

This quarry supplies the pulverizing plant at Annville.

slanting sides green with moss; 2,500 ft. of it for the main stream, 4,000 ft. for the branch. To-day the water level is controlled by pumping about 10,000 gal. per min. and the quarries are much deeper, much wider, and many times longer.

A very unusual feature of this quarry occurs at the extreme eastern end. The rock exposed to the elements gradually breaks up to a very fine powder-like material. Not all does this, as will be seen by the projection of hard rock noticeable in one of the pictures. Analysis of this disintegrated rock shows around 98 per cent. calcium carbonate in the natural state as taken from the quarry. It is being marketed commercially. The material passes through an Allis-Chalmers No. 6 primary crusher into a revolving screen with 1½-in. perforations. The "tailings" go through a hammer-mill. All material enters a storage-bin, from which it is con-

Screening and storage buildings at the Millardsville plant.

One of the 5 steam shovels at work in the Millardsville quarry.

veyed to a rotary drier and elevated to storage at the head of a Bethlehem pulverizer which grinds to a fineness of 95 per cent. through a 200-mesh screen. This material is bagged for agricultural purposes, chemical markets and for use as a filler for asphalt. A ¾-cu.yd. Erie shovel is used in the quarry to load into a skip hoist.

The central and western part of the quarry yields a good grade of commercial stone. Five loading stations are distributed along one side of the quarry face. Both hand and shovel loading are used.

There is a No. 10 Kennedy gyratory primary crusher located on the quarry floor with a 36-in. belt-conveyor to a stock-pile in the quarry. From the stock-pile a skip hoist is used to elevate the material to the crushing plant, which contains a No. 6 and a No. 25 Kennedy gearless, gyratory, secondary crushers. The No. 25 crusher has the driving motor built into the flywheel of the machine; the No. 6 machine is motor-driven and belt-connected. There is also a washing plant consisting of a barrel scrubber, 4 ft. by 12 ft., and the material goes from there to two Stephens-Adamson vibrating screens, 3 ft. by 6 ft. A McLanahan steel log-washer is used. All the equipment is electrically-operated. A fully-equipped machine-shop, with all the machine tools and blacksmith-shop equipment required to take care of repairs and general maintenance, is available. The hoists used for the inclined tramways at the loading stations are Orr & Sennbower machines manufactured in Reading, Pa.

At the central part of the quarries the pump-

The quarry at Palmyra.

house is located. It is equipped with one 6,000-gal. per min., one 5,000-gal. per min., one 3,500-gal. per min., one 2,000-gal. per min., three 1,500-gal. per min., and one 1,000-gal. per min. centrifugal pumps. Seldom more than 5,000-gal. per min. is required to be pumped out, but the other pumps are held in reserve for any unusual conditions that may develop.

Mr. Millard also operates a plant at Millardsville, Pa., about 16 mi. east of Annville. This plant is producing flux stone for blast furnaces, crushed stone for Portland cement and also commercial grades of limestone. It includes a complete wash-

View on two levels at the Swatara quarry. Note cars on trestle.

ing plant with all the screens required for the above products.

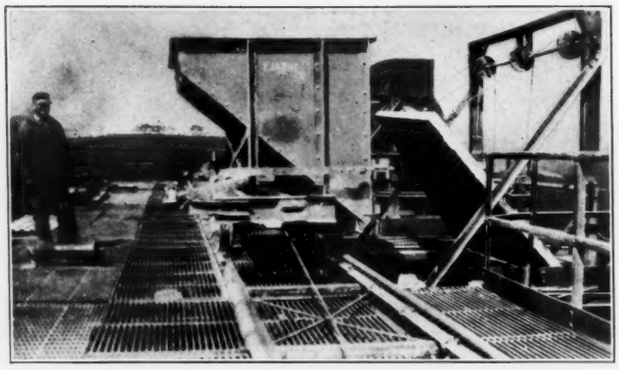
Another plant operated by H. E. Millard is located at Palmyra, Pa., which is about 4 mi. west of Annville. This plant is producing bulk lime only and uses 13 coke-fired stone-construction kilns employing the mixed type of feeding—a layer of coke and a layer of stone. The kilns are about 10 ft. inside diameter and 32 ft. high. An inclined tramway runs from the quarry floor up to the charging floor, where each car is dumped into a self-discharging bucket which opens something like a clam-shell, dropping the charge into the kiln. A stock-pile is kept on the charging floor to carry on continuous operation during rainy days when quarry work is abandoned. There is a heavy overburden at some parts of the quarry and room-and-pillar mining operations will be used for future developments.

The lime plant at Swatara is located on a continuation of the same vein of limestone that extends through Palmyra and Annville. Construction of this plant was begun about 1926 by the W. T. Bradley Co. A small opening had previously been made in the quarry, producing commercial stone and a small amount of lime, which was burned in the old-style pot kilns in the old abandoned quarry across the highway. This abandoned quarry, now partly filled with water, was one of the first operated in this district. About 1927 the building of four lime kilns was completed. May 1, 1929, the plant was purchased by H. E. Millard.

Storage pile of 4-in. to 12-in. stone at Swatara.

Four more kilns were installed and a complete hydrating plant added.

The quarry is in a vein of limestone about 300 ft. wide and is being worked at two levels. The upper face extends to about 60 ft. below the ground level and the lower face is 35 ft. high from the quarry floor. The rock strata are almost vertical and it is easy to get the rock broken down. Some of the best

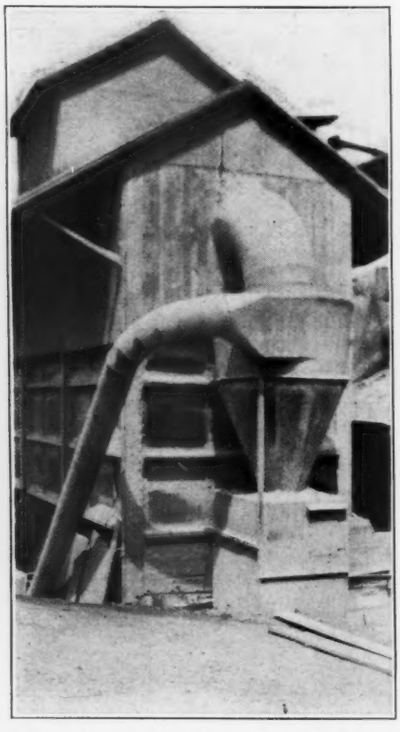


Car charging kilns at the Swatara plant.

rock runs under a large stone residence and as it runs up close to the ground level the house is being torn down and stripping operations will begin as soon as the *débris* is removed.

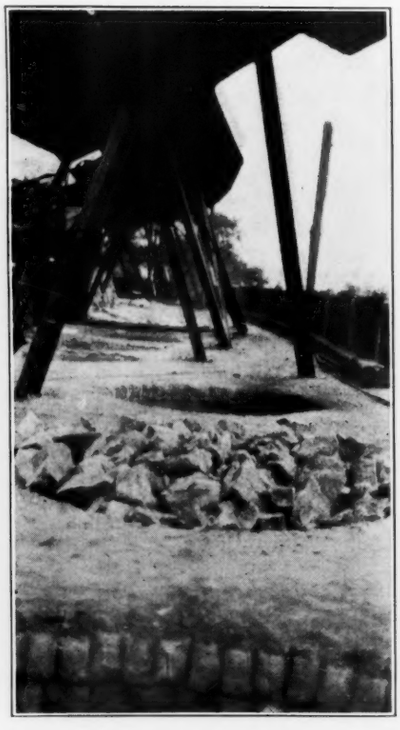
In the quarry most of the loading is done by hand, using mule-drawn quarry cars. Three inclined tramways bring the material out of the quarry. A sump hole with pumps is located in the quarry floor, pumping about 1,000 gal. per min.

The stone entering the crusher plant goes through a McLanahan roll-crusher, passes over a live-roll grizzly with 4-in. openings to a 36-in. belt-conveyor leading to a storage-pile. The available storage space will provide for full-time operation of the 8 kilns for a period of 48 hr. The "fines" from the grizzly are handled by an 18-in. belt-conveyor by which the material can be discharged into a secondary crusher, or by-passed to a second conveyor. This conveyor transports the material to a 4-ft. by 25-ft. revolving screen, where it is sized for commercial aggregates which are stored in bins or loaded into railroad cars or trucks.



Storage bins and loading plant at Palmyra.

E. D. Williams, general manager.



On top of the kilns at the Palmyra plant.

The clerical force of the Millard office.

Large stone from the storage-pile is loaded through hoppers into automatic dumping cars, which are drawn up the incline to the charging floor of the lime kilns. The hoist is a Lidgerwood, driven by a 50-hp. motor. The cars dump into the kilns, which are charged two or three times a day and are drawn regularly every 4 hr. The operation is conducted on a 24-hr. continuous schedule.

The kilns are of steel-shell construction, 11 ft. in diameter and 60 ft. high. The operating floor is about 14 ft. above the first floor and an operator's platform is supported from the kilns about 8 ft. above the operating floor, fitting around, and extending the full length of, the battery of kilns. From this platform the operator can inspect conditions inside the kilns and poke down any bridging that occurs in the burning zone.

Two gas-boxes, brick-lined, through which the raw producer gas is admitted, are located about 5 ft. above the operating floor and arranged diametrically opposite each other. Gas-mains, leading from the main header into the under side of each gas-box, are equipped with manually-operated butterfly valves for controlling temperatures in the combustion zones. Air to support combustion and control flame propagation is drawn through the cooling zone by exhausters mounted at the tops of the kilns. As producer gas has a fairly high heat value, enough air is required for complete combustion. Practically all the heat in the burned lime is returned to the combustion zone, thus performing the double function of cooling the product and pre-

H. E. Millard's favorite sport is riding horseback.

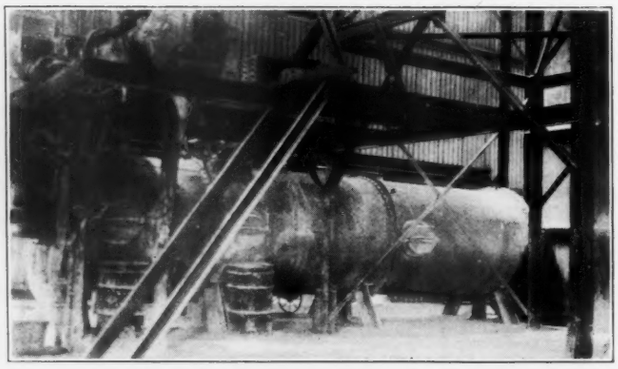
heating the primary air. This contributes considerably to the economical operation of the kilns.

These kilns are lined with refractory brick to diameters of 9 ft. 6 in. at the top and 6 ft. at the burning zone and some of the kilns are also insulated on the inside with a 4½-in. course of Sil-O-Cell brick. Tests are carried on to determine the value of this insulation and the effect of the resultant increase on the temperature of the lining.

Charging doors at the tops of the kilns are sealed after each charging operation to preserve the in-

The Millards—J. B. at the left, J. Benjamin, center, and H. E. at the right.

duced draft and properly to ventilate the products of combustion. While these doors are open the gas is shut off by manipulation of the gas-valves. Under each row of kilns a 36-in. pan-conveyor is installed to remove the burned lime which is discharged through gear-sector-and-pinion-operated double-leaf shears, hand-controlled. The gas producer is a heavy-duty, fully-automatic type manufactured by the R. D. Wood Co., and can gasify 600 tons of coal per week of 168 hr. of continuous operation. The eight kilns are at present producing about 1,000 tons of lime per 7-day week with a lime-coal ratio of 3½ or 4 to 1, using about 60 per cent. of the available capacity of the gas-producer. A gas-regulator is used to insure the best results. The coal used at present has a high volatile, low sulphur and ash content, and a high ash-fusion point. It is unloaded with a track-hopper and coal-chute to a bucket-elevator which discharges into a storage-bin with mechanically-controlled gravity feed to the producer. Much of the successful operation of the kilns depends on the size of the stone and the proper distribution of the charge. One-man stone is preferred and, by practice, enough smaller stone is included to result in low static air pressure in the kiln and an almost total absence of bridging as well as confinement of the burning zone to the proper limits.



A view of one of the hydrators.

The pan-conveyors under the kilns discharge into a 12-in. by 24-in. bucket-elevator which in turn discharges into two bins having a capacity of 100 tons and 150 tons, respectively. The conveyors are extended to form a picking table for inspection of the lime. Cores are consigned to cars and are dumped into a chute to the quarry where they are caught by a quarry car and returned to the kilns for reburning.

From these bins a 20-in. pan-conveyor is used to take the material to a 3-ft. by 17-ft. shaker screen, from which bulk lime is secured for shipment. A by-pass system is being installed to take the lime from the conveyor under the kilns straight to the shaker screen. This screen is now fitted with a removable cover-plate, so that material can be fed over the screen into railroad cars or trucks. From the shaker screen the "fines" (1-in. material and under) are taken to a bucket-elevator by an 18-in. belt-conveyor and are run through a Schulthess hydrator, and elevated to two Sturtevant separators, then to bins and baggers as a finished product in two grades of lime—building and chemical.

A by-pass arrangement is used in this system also to pass the material through a Sturtevant Moto-Vibro screen instead of to the hydrator, producing pebble lime ½ in. in size and under, chemical lime, and screenings, all of which are stored in bins with loading spouts for barrels or bags.

The buildings are built of structural-steel frames covered with Lyonore metal sheets made by the Maryland Metal Building Co. of Baltimore, Md.

European Cement Firms Combine

(*Continued from page 28*)

Prices are fixed by the cartelized plants through various zones, leaving the transportation costs of the finished product out of the reckoning. This is otherwise provided for by being based on the cost of coal carriage from its source to the various plants, this being considered a more equitable method than any other for arriving at parity.

Other European countries have their cement industries organized on syndical lines—Austria, Czechoslovakia, Denmark, Estonia, France, Hungary, Italy, Luxembourg, Roumania, Yugoslavia, Sweden and the U.S.S.R.

International agreements exist between the South and West German Syndicates and the Austrian and Hungarian organizations, each agreeing not to export to the other's territory. The North German and Swedish syndicates have a system of reciprocal imports, and associated plants in Esthonia and Czechoslovakia also enjoy a similar arrangement between themselves. The East German syndicate and the Polish industry have a like understanding.

German and Belgian producers have recently agreed to end price competition in the market in Holland, to which the newly established Dutch factory, the East Netherlands Cement Works, adheres. The Dutch trade gives a 40-per cent. quota to Germany, a 40-per cent. to Belgium and a 20-per cent. to the single-plant Dutch industry. This was the status at least until a production of 500,000 tons, the product of independent Belgian interests, began to invade the market, which brought in turn an abrogation of the agreement, believed, however, to be temporary.

France, Belgium and Luxembourg have agreed to the volume of French cement which might be exported to other contiguous countries on what is virtually a system of quotas.

An International Cement Syndicate created at Copenhagen includes German, Swedish, British and Belgian producers. The interested plants have an output of 50,000,000 bbl. per annum. It is to engage extensively, if not exclusively, in exports to the South American market.

An unsuccessful attempt was made in 1929 for cartelization between German and British manufacturers. The movement appears to have been dropped. Financial *rapprôchement* has been sought recently between French, Swiss and Belgian makers with the object of establishing ever-widening coöperation but, in general, a complete centralization of operation seems to be far from attainment.

Accident Prevention Plays an Important Part in Plant Management*

By JOHN PRINCE
President, Stewart Sand & Material Co.

MOST executives first became conscious of the need for safety through the financial cost of accidents. The executives of a large percentage of the smaller industries of the country, including probably all of the quarry industry, have come to realize the need for safety work of some kind within the last few years, practically all within the last ten years. I believe the quarry section of the National Safety Council has been organized for six years.

This rather recent awareness of safety on the part of these executives has undoubtedly come about through the increasing costs of industrial accidents. Before compensation laws were passed in many of our states, the employers' liability rates in this industry were relatively low, and the insurance companies carried the money cost of accidents without seriously disturbing the peacefulness of the management.

As society became increasingly aware of the overall costs of industrial accidents, industry was forced, through compensation laws, to pay an increasing percentage of this cost, with the result that the budget item for compensation insurance became larger and larger, until management began to consider what could be done about it. While most insurance policies carried certain provisions whereby the premium would be increased or decreased as a result of the individual record made by the insured, still these credits did not represent the full amount which many executives believed could be cut from their accident cost as the result of a good record in the reduction of accidents.

Among a considerable number of companies in several states, self insurance began to be tried. When this has once been started by a company, the executive sees the rather large money rewards which come through reduction of accidents, or the penalty for an increase in accidents. Right then the safety director becomes an important member of the executive staff, whose results can apparently be measured very accurately in dollars and cents.

From this point on I believe the thorough executive will begin to see a broadening picture and realize that safety work is not, in fact, a separate activity, but one which is very much tied up with other questions of great importance, such as the average cost of production and the ultimate profits of the operation.

Most executives, I presume, when looking over any plant, quarry or mill, can judge from the general orderliness and the smoothness with which the routine of operations is carried on, as to the relative unit cost of that operation. Is it not true that when one of you sees a plant of orderly appearance and smooth working routine, you are justified in expecting to find a cost sheet with relatively low costs, while the disorderly plant and the disorganized operation indicate a high unit cost on the cost sheet?

Is it not generally true also that the orderly operation will have the low accident rate, while the disorganized operation will have the high accident rate? If this is true then the problem of reducing the accident rate is but a part of the general problem of management. To accomplish this several things are necessary. The executive must provide suitable plant facilities which are in a broad sense a suitable machine to do the job.

Effective supervision by foremen, sub-foremen or superintendent is probably the most important link in the chain. Attention must be paid to the physical condition of the workmen, as the man who is physically unfit is apt to become both an inefficient part of the organization and a contributing factor to increased accidents either to himself or his fellow workmen.

The worker needs to understand the best way to do a job, and this is primarily a problem of supervision. He should be alive to the job, taking a real interest in it. This may be the result of both his selfish interest in making a living and gaining advancement, and the belief in the fairness and future of the company for which he is working.

Under the stress of present conditions it is probable that management can depend on the interest created by the fear of losing the job to greater extent than has been possible within the last ten years. Even though this may be true, will it not be a mistake for the management to depend upon this reaction? Is not discouragement apt soon to follow fear as the reaction of the employee, and will not discouragement greatly increase the difficulties of maintaining low cost and safe operation?

In the matter of equipment or the machine which is used in the operation, the safety committee of employees is quite apt to see first, as a possible accident hazard, the defects in the machine. After the safety committee of employees has operated for some time, it becomes evident that even with correction of the defects in the machine, many accidents continue to happen. Gradually it becomes evident to the committee that the personal factor accounts for perhaps 90 per cent. of the accidents. Next the safety committee is apt to pick on mistakes of judgment or carelessness on the part of employees, and in this their findings are apt to be much more severe in censuring or penalizing a fellow employee than in the management. The causes for such carelessness or lack of alertness which result in accidents is much more difficult to locate.

*An address at the 1931 Safety Congress.

Back of many accidents may be the unseen physical disability or mental disturbance of the employee. At this point I can not refrain from commenting on the possible consequences of the increasing importance given to the physical condition of the workmen. Perhaps compensation laws which have been forced on a reluctant industry, and frequently by pressure from organized groups of workers are partly responsible. This has resulted in an increasing use of physical examination either before employment or from time to time during employment, and the rejection of workers who are not physically sound.

In a recent examination with which I am familiar, covering some twenty-five truck drivers and employees of that class, over 40 per cent. were found suffering from hernia. They are naturally disqualified for heavy work, both for their own good, and in the interest of accident cost to the company. Frequently they are untrained for any other class of work for which they are physically fit. As these methods are employed by an increasing percentage of industries, such groups of physically unfit may become a real social problem. It has been suggested that, in this case, the large percentage of hernia found is at least in part the result of previous incompetent supervision. In many cases it is possible these men have not been instructed as to how, or how not, to handle heavy loads, or move a heavy object. At any rate, it is a fact that a man who has been partially ruptured may easily become a hospital case, requiring medical care and compensation for two or three months, and in many states this must be borne by the employer. In some cases the employer is able to relocate such men in different classes of work, but this can hardly be done with a considerable number.

Another of the important problems of management is that of obtaining and continuing competent supervision. In this I particularly refer to the foreman, sub-foreman or supervisor who comes in direct contact with a group of workers and directs the work. Frequently not enough attention has been paid to the general intelligence, interest, and ability of such a supervisor to anticipate events. The men who will really make competent supervisors are scarce. It seems to me management should make a great effort to have such supervisors understand the problems which confront the management, to the end that they will use fully their own ability to produce the desired results.

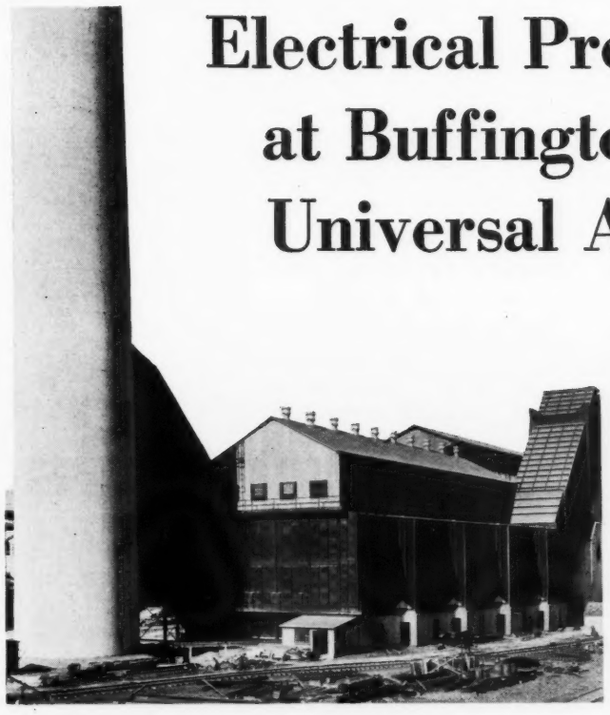
The executive must depend largely on the contact these supervisors have with the individual employee if he expects to maintain alertness of the individual, and the morale of the organization. It is through the supervisor that the executive can best make the individual man realize not only the interest the company has in his satisfactory work, but to a proper extent, an interest also in the welfare of the family and the general surroundings of the individual when not on the job. Family difficulties can easily create a worry which will come with the man to the job, reduce his interest in the work he is doing, and his alertness in doing it, to the extent that such a condition really becomes a real accident hazard. The management can probably not accomplish a great deal in correcting such difficulties. At one time or other they confront every one, and have to be worked out individually. The supervisor can, if he is aware of the situation, greatly improve it, either by letting the man lay off for a time, or even by giving him an opportunity to use the telephone. This must be worked out by the supervisor through his knowledge of the men under him. He must have the ability to realize the importance both to smooth operation, and a satisfactory accident record, of having employees who are competent and alert.

From my own experience I believe the employee who is really sold on the importance of safety will sometimes have a broader point of view on the subject than is held by the executive. Too often the executive is thinking principally of the money cost.

A year or so ago, after we had for several months experienced a greatly improved accident record, I was invited to attend one of the regular safety meetings of our organization. These have been primarily conducted by the men themselves who arrange their own program and conduct their own activities. It has seemed to me that results obtained in this way, under the leadership of the men themselves, will be more effective than when the company dominates such an organization. At the time I mention, I had become quite enthusiastic about the accomplishments of our safety organization, and in speaking to the men at one of the meetings, I volunteered the suggestion that a continuance of such a record should be rewarded by the company with some form of bonus. I thought I could see a saving to the company of $8,000 or $10,000 a year if such a record were continued, and I believed interest would be stimulated if a part of this were distributed in the form of a bonus. I made the suggestion without discussing the matter with the superintendents or those in charge of the safety work. The subject was referred to a committee, who later considered the proposition. Much to my surprise, I was thoroughly "called down" by the committee, who made it clear to me that safety work, when actively undertaken by the workers themselves, was not a result which could be bought and paid for by the company in dollars. The real benefits to the workers in the way of better earnings without lost time, the security of the family, and in the workers' own physical comfort, were the real incentives, and my suggestion of a bonus was energetically declined!

Progress will be made as executives get the broader view of safety work. It has in it much more than the direct money value in lessened accident cost. It is in fact but one part of the general problem of management. As we are able to inspire the right kind of supervisor to the full realization of the importance and responsibility of his position, as we are able to plan smoother or better-organized routine throughout the operation, and as we are able to place a sense of security and a real interest in his job in the daily life of the worker, then we will find a good accident record as a result, even though not the direct objective, of such good management.

Electrical Precipitators Installed at Buffington, Ind., Plant of Universal Atlas Cement Co.



The stack and precipitator building.

THE cement industry has watched with great interest the installation at Plant No. 6 of the Universal Atlas Cement Co., Buffington, Ind., of a Cottrell electrical-precipitator system. Almost 400 Cottrell installations have been made on this continent, of which number 42 are in Portland-cement plants, but this installation is the largest of its kind. Its rated capacity is 1,050,000 cu.ft. of gas per min., which is more than sufficient to handle the flow of gas at this plant when in full operation.

It is only fitting that this installation, which was recently completed, should be in the largest-capacity single cement plant in the world. Plant No. 6 is a dry-process operation with 14 kilns and a capacity of 16,000 bbl. of cement per day. It is also well known that this plant uses blast-furnace slag and limestone for raw materials and was one of the first to use slag for this purpose. Limestone is shipped in by boat from northern Michigan. The modern harbor and unloading dock built in 1927 to handle this limestone is still one of the most modern in existence.

This plant, when put in operation in 1903, was virtually out in the country. The Calumet District built up so rapidly, however, that the first dust-collecting unit was installed 15 years ago to take care of the kiln dust at a time when few such units were used in the cement industry. This particular installation was an early type of tube collector, efficient at that time, but since antiquated by the more efficient units now being made both of this and other types. Other types of equipment were installed later in the finish-grinding and coal-grinding buildings and in the cement pack-house. These are still being used.

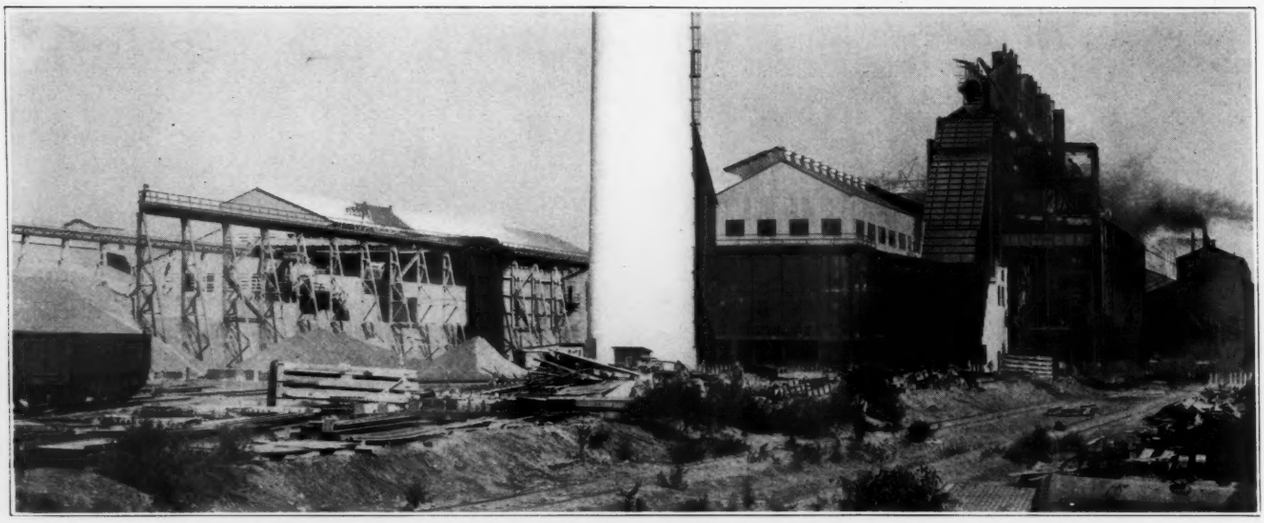
The new installation serves the raw-material-grinding, coal-grinding and kiln buildings, taking the dust and gases from 15 raw-material driers, 5 coal driers, 14 kilns, and all the grinding, elevating and conveying machinery in these departments. The plant now is 100 per cent. protected in all departments and is as dustless as it is possible for a dry-process cement plant to be. There is now no visible settlement of dust from the stack.

As is well known to most cement-plant operators, the collection of dust by the electrical-precipitation method is accomplished by passing the dust-laden gases through a high-potential, unidirectional, electrical field between two oppositely-charged electrodes. One of these, the negative electrode, is of comparativly small area; the other, of larger area, is called the positive or collecting electrode. The latter is grounded and the discharge electrode is insulated from it. The dust particles on passing through the field become electrically charged and are driven to the collecting electrode while the clean gas passes on and out of the precipitator. As dust also accumulates to some extent on the discharge electrodes these must be rapped periodically by mechanical means to remove the dust.

In the older types of electrical precipitators the dust adhering to the collecting electrode often caused electrical disturbances. Also, to prevent excessive accumulation of precipitated dust on these electrodes, they had to be cleaned at regular intervals. This was done by first shutting off the dampers on both ends of the precipitator and then dislodging the dust by means of mechanical rapping devices.

The graded-resistance type of precipitator has

Operating floor of the precipitator unit.



A view of the Buffington plant showing dust-collector installation at base of stack.

been developed during the past 5 years and is now the preferred type for cement plants using electrical precipitators. It was developed especially for use in plants equipped with waste-heat boilers, where the temperature of the gas passing through the precipitator is usually less than 450 deg. F. It can, however, also be used in either dry- or wet-process plants not equipped with waste-heat boilers, where the gases are cooled before passing through the precipitator. The advantages of the graded-resistance type over the older iron-plate electrode type are: Lower installation cost, lower power consumption and labor costs, and smaller space required to treat an equal volume of gas. The capacity of the precipitator required depends directly on the volume and temperature of the gas to be treated and on the efficiency desired.

An excessive accumulation of dust on the collecting electrodes is impossible with this type of

Switchboard controlling precipitators which are located immediately above.

unit and no rapping devices are necessary as the accumulated dust falls off due to its own weight. These electrodes are reinforced-concrete plates 6 ft. 6 in. wide, 12 ft. 4 in. high, and 2 in. thick, reinforced vertically with ⅜-in. steel rods spaced 6 in. apart and in contact with the steel frame around the electrode. These plates are suspended from a steel framework and are spaced 8 in. center to center. The steel rods and frame form the positive electrode and the electrical ground is obtained through the steel framework from which the slabs are suspended.

The discharge or negative electrodes are soft-steel wires suspended at 6-in. intervals between the concrete slabs and held taut by heavy weights. There are 5,400 such wires in this installation. A high-tension current energizes the discharge electrodes. A battery of 15 transformers step the current up from 440 v. to 50,000 v. for this purpose. The transformers are 15-kva. single-phase, 25-cycle units, and each has a rectifier which changes the current from alternating to unidirectional.

The precipitator installation at Buffington is of the graded-resistance type with all the latest improvements. It consists of five double-passage, double-deck units each 21 ft. 8 in. wide, 44 ft. 10 in. long, and 40 ft. 9 in. high. A total of 960 concrete-plate collecting electrodes are used in this installation, which occupies a ground space 44 ft. 10 in. wide and 137 ft. long. The top carries the operating controls and the high-tension transformers, the former being housed in a steel structure with corrugated-metal siding and roofing. The outer shell of the precipitator is made of copper-bearing sheet steel which is electrically-welded to structural-steel supports. More than three miles of arc-welding on the shell and framework kept a battery of five electric arc-welders busy 20 hr. a day while construction was in progress.

The dust- and gas-laden air from all the various sources previously mentioned (except the kilns) is driven by fans through flues to a large horizontal flue over the kiln building. The nine slag driers and six stone driers discharge to a single flue which, in turn, discharges to two smaller flues with induced draft created by two centrifugal fans. These fans are 9 ft. in diameter with blades 5 ft. 6 in. wide and each is driven by a 150-hp. motor through a V-belt drive. A smaller fan draws the dust from

the raw-material grinding and handling equipment through pipes to a small flue.

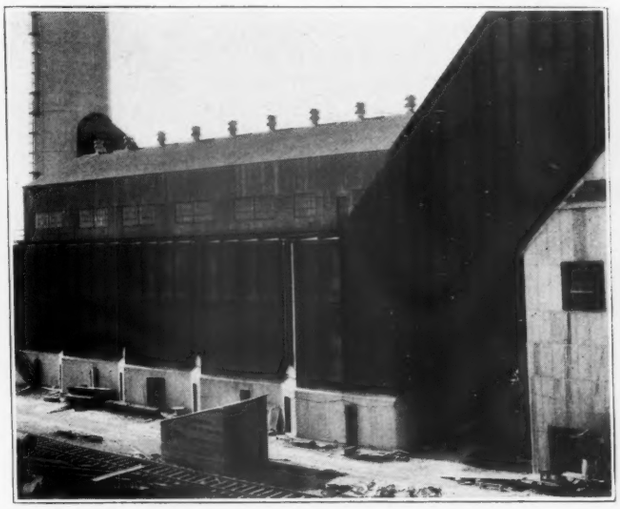
The three small flues discharge into the large flue over the kiln building, which is 22 ft. wide and 30 ft. high. The waste gas from the 14 kilns first passes through waste-heat boilers before being discharged into this flue. Each kiln has induced draft from fans located between the boilers and the flue. The kilns were originally 150 ft. long but were lengthened to 163 ft. when the installation was made.

The dusty air from all the above-mentioned sources passes through the large flue down a sloping inlet flue into the horizontal air-chamber in the precipitator building. This air-chamber is in reality an extension of the inlet flue and extends the full length of the building. The width of the chamber decreases by steps at each of the five precipitator units, corresponding to the decreased volume of air at each successive point. Motor-controlled multi-vane dampers at the intake end of each unit control the distribution of gas to the precipitator units.

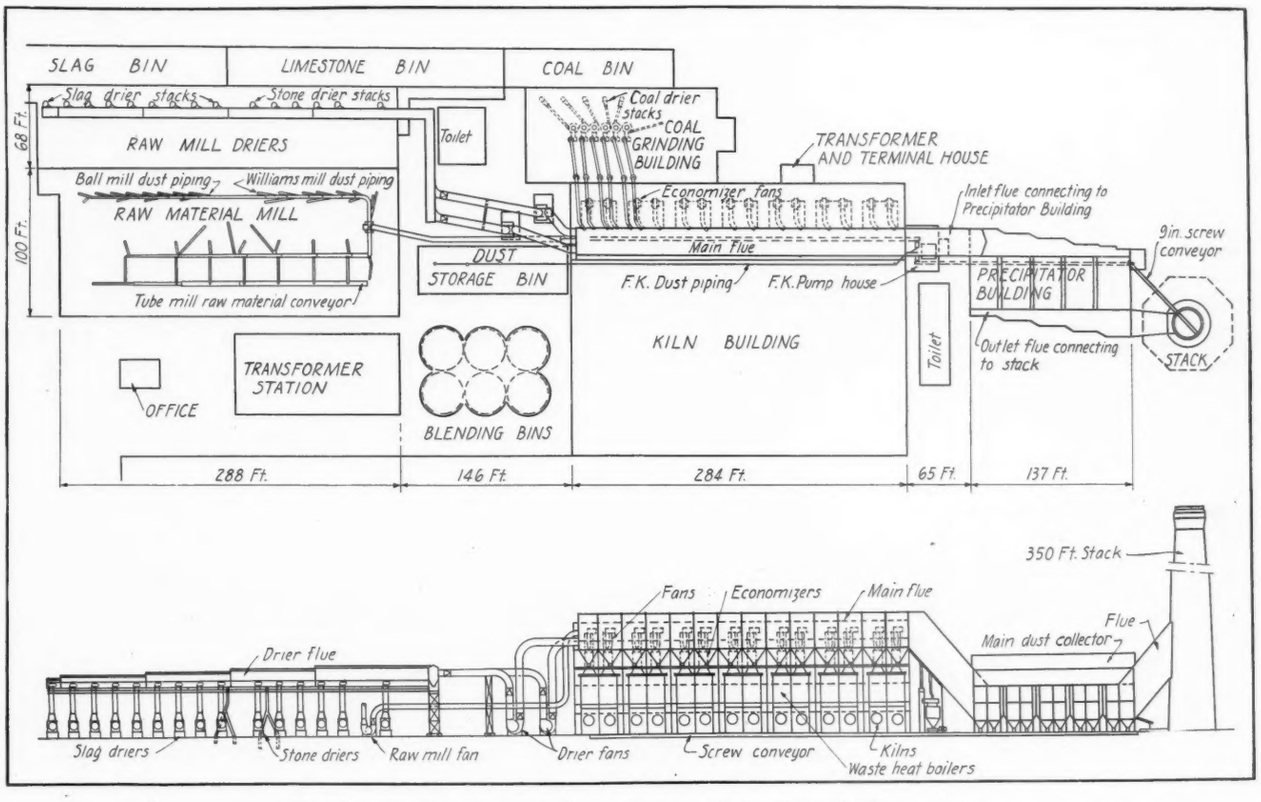
The passage of the gas through the precipitators and the removal of the dust particles has already been described.

The clean gas passes from the precipitator units through multi-vane outlet dampers into an outlet flue extending the full length of the building. This flue has exactly the same dimensions as the inlet flue, except that it increases in diameter at each successive unit to correspond with the increasing volume of air. The air is discharged through an inclined flue, which slopes upward to the point where it discharges into the 350-ft. concrete stack. This flue is also 22 ft. wide and 30 ft. high.

The dust from the precipitators drops into hoppers from which a system of screw-conveyors transports it either to a hopper in the dust-pump building or to the kiln-feed elevator. The main flue over the kiln building and the inlet flue to the precipitators have hopper bottoms from which screw-conveyors carry any settled dust to the same hopper. Some dust is also precipitated from the kiln gas as it passes through the waste-heat boilers and this is conveyed to the dust hopper in the same manner. Two 6-in. Fuller-Kinyon pumps convey all the collected dust back to a dust-storage bin



Feed end of collectors with switch-house above.



Drawing showing the general arrangement of the dust-collecting system.

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which feeds to the raw-material stream at the discharge end of the raw-grinding mills.

About 3 per cent. of the total amount of suspended dust is recovered by settling before reaching the electrical precipitator. This has shown an efficiency of over 95 per cent. and entire installation has an efficiency of over 98 per cent.

The single reinforced-concrete stack, serving as an outlet for all the air coming into the dust collector, is 350 ft. high and has an outside diameter of 34 ft. at the base and 25 ft. 3 in. at the top. The inside diameter is 15 ft. Work was started on this stack in the autumn of 1930 and it was built to a height of 150 ft. before work was suspended for the winter. The stack is painted with Atlas white Portland cement and is lighted at night with floodlights for the protection of air-mail planes which fly over this vicinity every night. It has become an important landmark and is visible for many miles in all directions. On a clear day or night it can be seen from Grant Park, Chicago, 25 mi. to the northwest, and from east of Valparaiso, Ind., 33 mi. to the southeast.

Unlike most stacks used in the cement industry, this one has a permanent, inclosed, steel safety ladder on the outside of the stack and extending from the top to the bottom. A steel platform about half way up the stack allows gas-volume and velocity tests to be made at any time through openings in the stack.

The concrete-slab collecting electrodes used in this installation were made in a completely-equipped temporary plant near the construction site. In this case they were made of Portland cement and blast-furnace-slag grits, although washed silica sand is generally used in other installations. The concrete was thoroughly mixed and carefully placed to prevent segregation or voids in the slabs. A special table, with a ratchet jigging device, was used as a further safeguard. The slabs were cured on a perfectly plain concrete floor which insured absolute uniformity and allowed the most approved curing methods to be used. After a reasonable length of time the slabs were carefully stacked in the manner used for seasoning high-grade lumber with wooden spacers separating the slabs.

This precipitator installation was designed by the Western Precipitation Co., Los Angeles, Cal., and was built under contract by that company. All work was done in coöperation with the engineering department of the Universal Atlas Cement Co.

Welding of Side Frame Puts Hammer-Mill Back in Operation

The economies that result from the use of the oxy-acetylene process in repairing large castings were recently demonstrated in a most convincing manner at a rock products company in the middle west.

The continuous vibration and stress incident to the operation of a large rock crushing hammer-mill proved too great for the side frame of the mill. It started to crack and, before it was noticed, a whole section of the frame broke loose. It was not possible, of course, to keep the mill in operation, and, as it was one unit of a continuous series of various-sized crushers and screens, it was imperative that it be repaired as rapidly as possible.

An inquiry quickly brought out the fact that a new side frame not only would cost about $1,500, but would take several weeks to deliver. Consequently an oxy-acetylene service operator was called in to advise the mill owners on the possibility of a repair by oxwelding, as the job was larger than any that their plant welders had handled alone.

The service operator assured them that the mill frame could be rapidly and economically repaired by bronze-welding, which would make it unnecessary even to dismantle the frame from the rest of the mill.

Accordingly, under his direction the broken edges were chipped off to form a bevel, and the broken section was clamped in correct position and alignment by means of U-bolts. Because of the location of the fracture and because bronze welding rod was to be used, extensive preheating was not required and the casting was soon ready for welding. Two welders worked together, using high strength bronze welding rod. This gave a weld of high strength that would resist the heavy stresses of operation.

The total cost of the work was only about 13 per cent. of the cost of a new side-frame casting. What pleased the mill owner most was the fact that the machine was in operation again in less than three days, thus reducing the interruption of production. The plant welders also now know the methods of oxwelding castings, so that future worries of lengthy shut-downs due to broken machinery are eliminated.—*Oxy-Acetylene Tips.*

Natural-Gas Consumption Climbs to New High Record in 1930

Although the natural-gas industry in 1930 fell short of the expansion in 1929, it established a new production record of 1,943,421,000,000 cu. ft. according to the U. S. Bureau of Mines. Completion of pipe lines into the southeast, however, was one feature of the 1930 expansion which enabled the industry to secure a broader outlet. In 1929, natural-gas production was 1,917,693,000,000 cu. ft. While the gain for 1930 was below the average annual increase for the past decade it represents a creditable showing in view of curtailment in the production of crude petroleum.

Consumption of natural gas by domestic and commercial users amounted to 376,407,000,000 cu. ft. in 1930 as compared with 359,853,000,000 cu. ft. in 1929. Industrial users of natural gas, including oil field operators, carbon black manufacturing, petroleum refineries, public utilities, Portland-cement and steel plants, etc., consumed 1,565,237,000,000 cu. ft. in 1930 as compared with 1,557,598,000,000 cu. ft. in 1929.

Crushed-Stone Assn. Warns of Increased Haulage by Motor Trucks

No Opposition Made to Higher Freight Rates, However, at Commission Hearing

CRUSHED-STONE producers made no strong plea against a proposed increase in freight rates in their brief, presented on behalf of the National Crushed Stone Assn., before the Interstate Commerce Commission by the legal firm of Walter, Burchmore & Belnap of Chicago. The brief merely urged that crushed stone be treated fairly in respect to competing materials. Since that time the commission has made its decision, proposing an increase of $3 per car for crushed stone as well as for sand and gravel.

The association's brief, together with some of the tables which were included in the exhibit offered by W. R. Sanborn, chairman of the transportation committee, was as follows:

The National Crushed Stone Assn., a voluntarily incorporated association of stone producers in the United States and Canada, does not appear in the proceeding for the purpose of opposing the carriers in their efforts to obtain increased revenue. The association is quite in sympathy with that purpose, in part from a selfish standpoint, since the members of the association sell large quantities of stone ballast to the carriers and, consequently, have a direct interest in a prompt restoration of their prosperity. An increase in rates, however, does not necessarily mean an increase in revenue. Consequently, the association participated in this proceeding and presented W. R. Sanborn, a director, regional vice-president, and chairman of the transportation committee of the association, as a witness for the purpose of acquainting the Commission with the probable effect of an increase in rates upon the crushed stone traffic. Mr. Sanborn testified at the Chicago hearing, and the gist of his testimony is as follows:

The National Crushed Stone Assn. is willing to have the rates of its members increased, to the extent that production can stand an increase in rates without cutting down the volume of their traffic. Our exhibit shows, however, that the production of crushed stone and the competing commodity, building and paving sand and gravel, in the United States, far exceeds the tonnage of these commodities which are being transported by rail carriers, and that, year by year, the production has increased in a substantially greater ratio than has the railroad tonnage.

Incidentally, in connection with this exhibit it should be noted that, in so far as possible, the stone, sand and gravel production in the United States has been segregated into three divisions, *i. e.,* (1) crushed stone, sand and gravel used for concrete and road construction, this production being largely affected by truck competition, (2) crushed stone, sand and gravel used for railroad ballast, this generally being non-revenue tonnage, and (3) special purpose stone and special purpose sand and gravel, such as building stone, paving blocks, furnace flux, agricultural limestone, glass sand, molding sand, etc., this third classification, however, not being generally affected by truck competition.

Statistics were also offered at the Washington hearing on behalf of the National Sand and Gravel Assn. in respect of stone, sand-and-gravel production, and the extent to which these commodities are transported by rail carriers, but in the exhibits just mentioned no effort was made to show those commodities in separate divisions.

The general conclusion to be drawn is that there is a very marked trend in the case of crushed stone, sand and gravel used for concrete and road construction towards transportation by other means than rail carriers. This trend is particularly noticeable when the distribution is at short-haul points, even when from pits and quarries which have railroad connections and which were originally constructed with a view to distributing their entire output by rail. The normal trucking radius now ranges from 25 to 30 miles, and a 25-mile truck haul is not unusual, even to points where the freight rate is as low as 63 or 70 cents per ton.

TONS OF STONE, SAND AND GRAVEL SOLD OR USED IN THE UNITED STATES, 1923-1929

(Data compiled from reports of U. S. Geological Survey and U. S. Bureau of Mines)

Year	Stone	Sand and Gravel	Total Stone, Sand and Gravel	Change for Each Successive Year as Compared to 1923 (*per cent.*)
1923	103,318,660	139,932,153	243,250,813	100
1924	103,184,120	156,230,063	259,414,183	107
1925	115,851,370	172,001,473	287,852,843	118
1926	124,496,360	183,100,818	307,597,178	126
1927	136,345,130	197,454,269	333,799,399	137
1928	133,869,510	209,118,868	342,988,378	141
1929	141,109,580	222,571,905	363,681,485	150
1930	[1]	[1]	.....	...

[1]Report not yet available.

Crushed stone, sand and gravel are such low-priced commodities that the transportation cost is of more than ordinary importance. Competition compels the producer to utilize the transportation agency which affords the very lowest cost. Consequently, even under the present rate level, from 40 to 50 per cent. of the New England production is now being transported by other than rail carriers. In the remainder of official classification territory, from 25 to 35 per cent. is being trucked. In Illinois, where the stone-producing points are widely separated, the truck movement is relatively low, averaging in the neighborhood of 10 to 15 per cent.

If the rates be increased, undoubtedly much more of the short-haul business will be taken from the rail carriers.

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TONS OF STONE, SAND AND GRAVEL TRANSPORTED BY RAILROADS, 1923-1930

(Data from Reports of the American Railway Assn.)

Year	Carloadings	Carloadings Converted to Tons, Using 50 Tons as Average Load per Car Over Period	Change for Each Successive Year, as Compared to 1923 (*per cent*)
1923	2,062,355	103,117,750	100
1924	2,195,926	109,796,300	106
1925	2,382,311	119,115,550	115
1926	2,620,069	131,003,450	127
1927	2,741,522	137,076,100	133
1928	2,667,160	133,358,000	129
1929	2,593,575	129,678,750	126
1930	2,224,095	111,204,750	108

It is probably true that, considered solely by themselves, the long-haul stone rates could stand a 15 per cent. increase. Unfortunately, however, if so increased, the traffic which now moves from existing quarries to long-haul consuming points will be displaced by production at wayside pits and quarries within a short trucking radius of the important consuming centers. Mr. Sanborn gave numerous illustrations of how even the present rate level has induced the opening of such wayside pits and quarries.

Because of these circumstances, there is a serious question in the minds of the members of the association as to whether or not a general increase in rates would actually result in an increase in net revenues.

In the event, however, that the Commission is disposed to permit the increases to be made, there remains for consideration these questions: (1) How should the increase be provided, by a flat amount in cents per ton or by a percentage method? (2) Should the increase be the same for all competing commodities? And (3) should the carriers be permitted to take only so much of the increase as in their judgment they would be able to take and still hold the traffic to the rail lines?

Upon these three questions Mr. Sanborn expressed the following as the views of the association:

The increase, if made, should be by the percentage method, thus avoiding the maladjustment of rates which followed U. S. R. A. General Order No. 28 when all crushed stone, sand and gravel, but not crushed slag, rates took a flat 20-cent-per-ton increase. The percentage method is particularly desired if the increase authorized be the full 15 per cent. If only a nominal increase is authorized, as for example the equivalent of 5 cents per ton on all stone rates, perhaps the flat increase would then be preferable.

As to competing commodities, crushed stone is used for the same purposes as gravel and crushed slag. Whatever may be the character and amount of the increase, it should be applied uniformly to all three of these competing commodities.

As the carriers appreciate, there are a great many rates on crushed stone which can not stand any increase at all if the rail carriers are to be in a position to retain the traffic. Accordingly, the association urges that, if an increase be authorized, the carriers be granted specific authority to apply only such part of the increase as in their judgment they may be able to take and still hold the traffic to the rail lines.

COMPARISON OF TONS OF STONE, SAND AND GRAVEL TRANSPORTED BY THE RAILROADS WITH TONS OF STONE, SAND AND GRAVEL SOLD OR USED IN THE UNITED STATES, 1923-1929

Year	Stone, Sand and Gravel Sold or Used	Sand and Gravel and Stone Transported by the Railroads	Total Sand and Gravel and Stone Sold or Used Transported by Railroads (*per cent.*)
1923	243,250,813	103,117,750	42.4
1924	259,414,183	109,796,300	42.4
1925	287,852,843	119,115,550	41.4
1926	307,597,178	131,003,450	42.5
1927	333,799,399	137,076,100	41.0
1928	342,988,378	133,358,000	38.8
1929	363,681,485	129,678,750	35.7

Producers and Exhibitors Meet

(*Continued from page 34*)

Mr. Garber, whose Christian name was forgotten long ago, all for the love of "Mike," rendered a historical account of the division's early struggles and called upon the various ex-chairmen present to rise and be recognized. They were received with becoming appreciation.

All in all, the dinner was a thing of joy from every standpoint. Even to the casual observer, the big impression of the meeting was this: "We *must* make Pittsburgh the biggest and best ever!" Behind it all was the comradeship that brings these men together year after year, ever more solid and faithful to their ideals and to their friendship for one another.

Advocates Public Construction to Provide Needed Employment

The paramount need of locating jobs for the unemployed was stressed recently by Governor Larson of New Jersey, who does not favor leaving the entire burden of relief to public charity.

"Before resorting to charitable measures," said Governor Larson, "our relief agencies should exert every effort to provide jobs for workers."

The governor pointed to the large public-works program of New Jersey as an example of the steps which can and are being taken to provide employment. He said, "Highway and building authorities estimate that fully 75 per cent. of the money spent in construction is paid in wages to someone along the line, either in actual building or in supplying materials. Relief money devoted to improvements will go almost as far as that expended in direct charity, and it will bring lasting benefits.

"There is enough needed construction pending on national, state, county and municipal projects," he went on, "to meet adequately the demands of the present emergency, if steps will be taken to get the work under way. Over six billion dollars in contemplated improvements has been reported to the President's Committee on Employment since last November. Yet only about one-third has reached the construction stage. At least half of the remainder could be brought to contract almost immediately by determined action on the part of officials."

The Foreman's Responsibility in Safety Work in American Industry*

By PAUL R. KUHN

Asst. Vice-President, Penn Central Light & Power Co.

A COUPLE of years ago the Theatre Guild of New York produced a play the title of which was "R. U. R.", which stands for "Rosson's Universal Robots". The plot of the play was based on a mechanical genius who developed a robot that could do all kinds of work—plow the fields, operate machines and fight wars. The utility of these robots was so apparent that production of them was carried out to such a degree that they were in universal use and were gradually supplanting the human being in many tasks. After a while the robots became so powerful that they decided to exterminate all human beings on the earth except one lone man who made these robots with his hands in the factory. The only reason why the robots spared him was due to the fact that he was the only one who could be found who worked with his hands. After the robots had exterminated everybody on the earth with the exception of this one worker they felt that they had everything to themselves but they soon learned that among those whom they had exterminated was the genius who had conceived the robot and he was the only one who had the secret covering its manufacture. This play was somewhat of a satire on the mechanical age but it does bring out an important point—that above all the mechanics of the age, the human being with his mind is far supreme and is necessary for progress and continued existence.

Paul R. Kuhn.

I believe that all too frequently we lose sight of this very fact and fail fully to comprehend the intricacies of the human mind and the habits and actions of individuals. Any executive, superintendent, foreman or safety director, who is sincerely interested in safety for any length of time, soon begins to realize that any safety program to be successful must be based on the approach to the individual human being. "Why do some companies have accidents, while others have none or have reduced them to the minimum?" is a logical question for anyone engaged in industry to-day to ask himself. The answer to the question is simply that the first class of companies have not solved the accident problem or they are not sincerely interested in it, while the companies in the second class are wholeheartedly back of accident prevention.

There are really just three major elements in any successful accident-prevention program, namely, organization, attitude, and discipline. Many companies that are unsuccessful in the prevention of accidents may have an organization on paper but they surely do not have the other two elements, attitude and discipline. Some companies may have certain individuals in them who have the right attitude but the company has no organization and discipline, therefore, accidents are always on the increase or stay at the same level. Some companies have neither organization nor attitude but they have discipline. They feel that the best way to get results is to discharge an employee when he makes a mistake. I could go along here indefinitely breaking down these major elements into various sub-elements, but I believe that it is apparent that successful accident-prevention work is based on the triangle of organization, attitude, and discipline.

What makes safety work difficult, if it is difficult? Well, in my estimation, it is simply due to the fact that we are dealing with the human being which is the most intricate piece of machinery in existence. It is a piece of machinery that we think we know the most about but of which we really know the least.

Several months ago we took up at the safety meetings an analysis of some of the accidents which took place during the year 1930. Invariably the analyses disclosed that the accidents were entirely due to three fundamental causes: (1) Violation of safety rules, (2) improper methods, or (3) poor judgment.

No company fails at some time or other to pick up one of those famous individuals bearing the name of Johnnie Know-It-All. He is the fellow who has the idea that the safety rules have been developed by some person with a white-collar job sitting 250 mi. away with nothing to do, and knowing nothing or less about working conditions. Johnnie Know-It-All pictures this fellow as one who wants to do something but does not know what to do and finally decided to issue some company safety rules. When Johnnie Know-It-All gets his rule book or rules he proceeds immediately to eliminate from the rules all those which he does not like, and even tries to convert some of his co-workers to his own brilliant and judicious ideas on safety. About this time Old Man Experience steps in when Johnnie Know-It-All is doing a job according to his own rules, with the result that Johnnie Know-It-All goes out for the full count and Old Man Experience is awarded the diamond-studded championship belt.

* Presented at the 1931 regional cement safety meeting, Pittsburgh, Pa.

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After 56 sec. on the canvas Johnnie Know-It-All wakes up shouting "Who was that fellow that hit me?" A voice from the distance shouts, "Why, that was Old Man Experience—the man who made up the company's safety rules." Leaving Johnnie Know-It-All to recuperate with the assistance of the ammonia salts we will pass along.

Company safety rules—what are they and where did they come from? To us company safety rules represent the experience and knowledge gained from accidents and near accidents due to unsafe conditions and practices in the operation of companies engaged in similar operation. If you doubt this interpretation, we would suggest that to-morrow you take your own company safety rules and go over them one by one and endeavor to recall how many accidents or near accidents occurred or nearly occurred within your personal knowledge as the result of violations of the rules. We believe that this background of the development of safety rules is important, because too frequently a full appreciation of the value of safety rules is lost sight of through misunderstanding as to their origin and development.

With the view of offering constructive criticism we are of the opinion that one of the big causes of failure on the part of most foremen is due to their unwillingness to assume the responsibility which has been assigned to them, particularly when it comes to enforcing safety rules among the employees. We confidently believe that no man should be a foreman unless he is willing to take this responsibility. We make that statement simply because the word "foreman" means a man who oversees and directs other men and no person can oversee or direct without feeling a sense of responsibility. The foreman's responsibility does not apply merely to the quality and quantity of material produced in a day but also to the safety of the men coming under his charge. When a company turns over to a foreman a specified amount of raw material to convert into finished products, he is expected and required to render an account of the raw material in the manufactured products. There is nothing unreasonable about this requirement and the company and foreman understand each other very thoroughly on this point. The situation surrounding the human element should be just as clear but unfortunately it is not always the case. When the company turns over to a foreman ten healthy and whole men to do a job it is not unreasonable to expect that the foreman should render an account for these ten men and turn in ten healthy and whole men at the end of the job. Why there should be any distinction between responsibility for raw material and that existing for the human element is not clear to us. We do not believe that there is any distinction in the mind of any industrious, progressive and safety minded foreman.

For what particular reason have we put so much emphasis upon the responsibility of foremen? Well, just due to the fact that any set of safety rules is only as valuable as the extent of the appreciation of the foremen in the company for those rules and this necessary appreciation can only come about when foremen know, feel and execute their responsibility.

Perhaps some of you are now inquiring, "Of what use are safety rules to the foremen?" Well, I do not believe that I would want to be a foreman without a set of safety rules defining my responsibilities as well as those of the managers, superintendents and employees. I base this assertion on the point of view that safety rules would make it a good deal easier for me to discharge my responsibilities and because there would be less likelihood of differences and misunderstandings as to our duties. You well know that differences between persons occur in life because they do not understand each other and it is equally true that mistakes and accidents occur in companies because the functions and responsibilities of individuals in the companies are not clearly defined and understood.

Improper methods are the cause and source of many accidents. In many cases some of the accidents which can be attributed to this cause are closely related to violation of rules and are in no way attributable to the failure of the foreman. On the other hand numerous accidents occur from the use of improper methods on the part of employees, and they could have been prevented with a little more effort on the part of the foreman. Too frequently the wrong man or group of employees is picked to do a job. Inexperienced employees are sometimes selected to do a piece of work without any particular thought, on the part of the foreman, being given to their qualifications. Instructions, if given, are quite often stated in such a vague and indefinite manner that the employees are not fully conscious of the best procedure to be followed in doing the job. Quite often foremen and supervisors assume, because of the length of service of the employees, that they should know the best methods to be pursued. This assumption has been the cause of more than one accident, many of which have been serious and fatal ones.

Proper methods are simply orderly procedure, which is the basis of successful, efficient, and safe work. The foreman, through his superior knowledge, foresight, and ability, is the person assigned by the company to direct the procedure or the operation. Directions should come, not after a job has been started, but before actual work is launched. The foreman should have a clean-cut picture in his mind of the best way to do the work and exactly what is needed in the way of tools, material, and equipment. Above all, he should know in advance what type of men will be needed, their character, their dependability, their ability for team work, and, in addition, their attitude toward safety and their reaction toward receiving and following instructions. A foreman who looks at a piece of work in this manner will find that, if he has the right human element, the actual work itself can be very readily directed.

(Continued on page 65)

Enforcing the Law of Supply and Demand as a Cure for Depressions

By V. V. KELSEY
Vice-President and Sales Manager, Consolidated Feldspar Corp.

A GREAT deal has been written and much has been said since the stock crash of 1929 regarding ways and means of lessening business depressions in America and, at the same time, correcting these depressions when they develop. For the most part the plans presented have been very general in their scope. Almost invariably these suggestions outline plans to be executed by the government. On every hand we hear that "there is too much government in business; business should have less governmental regulation and more freedom." Then immediately we listen to the suggested correctives and almost invariably the plans are for the government to apply the corrective measures. If there is too much government in business now, why ask for more? If there is too little freedom in business, why reduce it by further governmental regulations? Why not accept a plan, free of all the usual generalities and one that is free from regulation by the government, thus immediately eliminating politics with all its shortcomings?

In giving consideration to the plan that follows, such consideration will be far more effective in constructive ways if the plan is accepted impartially and also accepted in principle without too much regard to any of the suggested details. The details are more or less incidental and will therefore take care of themselves by the acceptance of the idea in principle.

In a recent address to the National Assn. of Credit Men,[1] James A. Emery, general counsel of National Assn. of Manufacturers, dealt with business recovery and the anti-trust laws and opened his remarks by saying: "We live in a collective, interdependent coöperative society which can neither maintain its existence nor repair disorders without coöperation among its parts. Combination in every form is the natural form of expression."

His remarks in this connection are both interesting and significant. The real problem is to find ways and means of controlling combinations and making genuine coöperation mandatory. For years it has been believed that the only way to accomplish the control of combinations and demand genuine coöperation is by government regulation. That this procedure as promulgated and made effective has proved to be a failure is almost universally accepted. Why continue to compound a mistaken policy? The question arises: How, then, and in what manner can business combinations be controlled and genuine coöperation be made mandatory? Another question immediately arises: How can the law of supply and demand be harnessed and how does it affect business combinations and co-operations? The second of these questions will be discussed briefly with the hope of showing its relationship to the first.

The age-old law of supply and demand is the one that permits us to enjoy prosperous periods and to combat periods of depression, provided that this law is utilized. Apparently it has not occurred to many to inquire whether or not this economic law can be regulated and harnessed so as to be useful to mankind. Rather definite suggestions will be made in this discussion, outlining a concrete method of accomplishing this. This plan will at the same time make clear a method of controlling combinations and providing ways of making genuine cooperation mandatory,

In order to take an impartial view of these suggestions a few fundamental facts by way of illustrations will perhaps not be out of place. First, let us consider cooperation. In a number of our daily endeavors there are certain very definite written rules that must be followed. A violation of these rules results in an immediate penalty. The result is that coöperation of the proper kind is accomplished in practically all cases.

Business has no written rules. Business is a game similar to a remarkable degree to the games of golf, foot-ball, tennis, base-ball, chess, checkers, bridge, etc. In all games there are certain very definite rules governing the conduct of these games, the one outstanding exception being the game of business. While it is true that business has no written rules there are certain understandings which are variously interpreted at various times under various conditions. There is no arbiter. There is no umpire. Business applies its own interpretation to suit its own condition, which means confusion because of the various interpretations. This is not true of any other game. In all games, with the exception of business, penalties are immediately imposed for violations.

If you watch any of the foot-ball games this autumn you, of course, will realize that, the minute an offense is committed in violation of the rules, a

MOST of those who comment on depressions, their causes and cure, are economists, lawyers or politicians. The economists accept them as inevitable and try to cheer us by endless tables of financial statistics and somber graphs of peaks and valleys. The lawyers point grimly to legal tradition and stress the inalienable rights of man to "free and unrestricted competition." The politicians shout for any theory or policy which seems to have a "popular" appeal.

From business men one seldom hears, so it will be mentally refreshing to read this analysis of a business man who not only faces the practical effects of business depressions but refuses to accept them as inevitable, refuses to hope for relief in outworn legislation, and refuses to be led by political clamor. The editor will gladly publish comments on Mr. Kelsey's ideas.

[1] PIT AND QUARRY, Sept. 23, 1931, p. 61-63.

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penalty will immediately be imposed by the proper official on the field. If some member of a foot-ball team is off side, then this player, along with his ten team mates, will be penalized five yards. If a member of a foot-ball team is seen holding an opponent he and his ten team mates will be penalized fifteen yards.

The result of these penalties, which are immediately effective, brings about genuine coöperation on the part of the members of each team and precludes excessive violations. The official on the field who has the authority to fix the penalties for the offenses is not required to engage in an exchange of correspondence, neither is he required to ask for confirmation of his decision from any outside agency. He complies with the written rules. He is the sole and ultimate arbiter.

If you watch the game of base-ball, or even engage in playing the game of base-ball, you know the penalties that will result from violation of any of the written rules. If you are playing a game of golf, bridge or tennis you are fully aware of the written rules. You do not violate them because you know the penalties and the result is that you conform to the rules and thereby coöperate.

Contrast these conditions with the game of business, where there are no written rules, where cooperation is a much-hoped-for desire but which in most instances fails to make itself apparent. Contrast business with organized base-ball—business with no written rules, with no requirements for mandatory coöperation, with governmental laws saying that it must not combine except under certain conditions and then not in restraint of trade. Organized base-ball has definite written rules, makes coöperation mandatory and is a combination, but certainly not in restraint of trade. Organized base-ball is the outstanding professional game which all Americans point to with pride. It represents a trade association or combination that points the way for other trade and business associations. No one would spend the time to see a professional base-ball game, not to say anything about money, if it were believed for one minute that it was not sufficiently organized to preclude corruption, price-cutting, deceit, or any other unfair practices. We all know that any violation of the rules of this combination will result in immediate penalty by the directing head of the base-ball industry. The result is that we have a national game that has no peer.

Business should be permitted to organize itself along similar lines; in fact, it will be necessary to require business to organize itself along similar lines in order to regulate the law of supply and demand and to control the periods of prosperity and depression. To bring about this desired condition, which is both practical and sensible, we must start with certain fundamentals, give consideration to them and to the methods by which they can be utilized. The proper control of business during prosperous periods is as necessary as proper control during periods of depression.

The human being is a ready addict to habit. Habit develops into tradition and these two become inherent if permitted to continue sufficiently long. It is a difficult thing to overcome the inertia of habit. Attempts to make constructive changes in our methods of living, in our laws, in our daily habits are difficult to accomplish, but to succeed is to overcome the inertia of habit and tradition. To accomplish this is not impossible. It is only necessary to consider such changes as having very definite ends and to follow positive programs with a determination that refuses to consider the negative, which is immediately set up in opposition to the positive. In the solution of any problem, and, therefore, in harnessing the law of supply and demand with the idea of decreasing the degree and time of industrial depressions, it becomes necessary to pursue positive and constructive courses, whereby the objections which represent the negative side are overcome.

IT should be recognized by everyone that industry is the foundation of all wealth in this country. As a result of this wealth we have an exchange called money. Money merely represents wealth; it is not in itself wealth. This being accepted, we are therefore dependent upon successful industry for public welfare. For instance, agriculture, banking, insurance, public utilities, transportation, science, professions, educational institutions, charitable institutions, the maintenance and development of our municipalities, our states and our federal government are all directly dependent upon successful industry. To limit the activities of industry brings about certain unfavorable conditions that disastrously affect the sale and distribution of services and commodities and results in depressed conditions. It precludes fair and reasonable competition and is, therefore, a detriment to public welfare.

We hear so much to-day about unemployment insurance, doles and similar measures, presumably for the purpose of correcting the suffering resulting directly from business depressions, but this is a glaring example of our attempting to solve a problem by negative means instead of by positive means. A negative solution has never corrected an unfavorable situation. Only the positive can bring this about. The inequities in our industrial regulatory laws are also glaring examples of negative action versus the positive. It appears that practically all our would-be regulatory laws are based on negative ideas. The number and extent of the inequities of our industrial laws are appalling. For instance, our laws say that if industry fails to earn a profit on its efforts and investments, this failure constitutes a violation of the laws. For example, failure to make a return on the investment results in bankruptcies and receiverships, which are in direct violation of the laws. This represents the result when profits are not earned.

Contrast this with the laws which state that, if two or more industries engaged in the same line of endeavor plan to coöperate for their best interests, for the interests of the public, and for the purpose of earning a reasonable return on their investments and efforts, they violate some of our regulatory

laws—specifically, the Sherman and Clayton Acts—and for the reason that they earn a profit. Apparently there is no middle ground. If industry fails to earn a profit it violates the laws. If industry by coöperative action does earn a profit it again violates the laws. Perhaps no better example need be cited to prove the inconsistency, ineffectiveness and inequities of our present industrial regulations.

It is more of a crime to ruin industry by trying to comply with certain regulations than it is to stabilize industry by violating some of the regulatory statutes. It is very much against the law for two men to engage in a fight. It is no violation of the law for two or more industries to engage in a fight. In the first case the fighting is limited to two individuals and, at most, very little harm can be done and very little suffering can result. Picture, if you will, the tremendous harm that is done, and the enormous suffering that follows, when two or more industries fight. A combat between two individuals is classed as a fight, while a war between two or more industries is looked upon as healthy competition no matter how destructive.

If a policeman happens along at the time two men are engaged in combat they are frequently asked to settle their difference peaceably and they generally do, and they walk away together as friends. If two or more industries are engaged in a battle involving millions of dollars and affecting thousands of people, the government and its laws state that under no circumstances shall they be permitted to settle their differences peaceably and by coöperative action for the benefit of the public. They are required to continue this battle under the caption of "competition." Certainly we need some method of mandatory coöperation.

A NUMBER of laws that attempt to regulate business and commerce were enacted at a time when they appeared necessary, and they were developed without providing methods for making these laws adaptable to changing conditions. Laws which were intended to be beneficial to commerce and for the protection of the public and which have been on the statute books five years or longer are obsolete to-day; therefore they can not be applied to business conditions of to-day or those of to-morrow.

It is believed that most of the so-called business regulatory laws were developed through fear that certain conditions might develop and result in a restraint of trade. This is another way of saying that they were not predicated upon constructive thoughts. They were developed on negative ideas instead of positive ideas. Fear is always negative. Constructive thinking is positive. The negative method of developing laws by our Congress and general assemblies has become both habitual and traditional. It is therefore necessary that the inertia of habit and tradition be overcome in order to pave the way for constructive legislation, permitting industry to regulate itself, by itself, and for itself for the benefit of the public, and thus make useful and usable the law of supply and demand, and thereby largely avoid the business depressions which we have been experiencing since this country became an important industrial nation.

In pointing out some of the iniquities in our present laws the attorney general recently stated that "the overproduction, low prices and resulting waste in the field of natural resources such as oil and minerals have given rise to the assertion that combinations to restrict production and thus raise prices are lawful, which under normal conditions would be considered illegal." If it is a good thing to harness the law of supply and demand in times of distress, why is it not wise to follow this same plan in normal times? The answer to this is obvious.

Agriculture has been given certain legal liberties in permitting it to utilize the law of supply and demand by the control of overproduction. Industry has not been given this privilege. For instance, the secretary of agriculture in his report for 1930 says, "The answer to overproduction is less production. I want to emphasize the need for equitable, intelligent, systematic and collective action to bring supply into better relationship with demand. . . . The primary duty of the [farm] board is to help farmers organize coöperative marketing associations for the improvement of the distribution of farm products and to aid in preventing the production of surpluses."

Why not let industry coöperate? Why not legalize the methods by which industry will be permitted to coöperate and at the same time make mandatory industrial coöperation? The method by which industry can be required to coöperate for the public welfare, the method by which industry can be put on a prosperous basis, and the plan by which the law of supply and demand can be harnessed and made useful for mankind and thereby correct the present depression and preclude further serious depressions, is to have Congress pass a law requiring industry to organize itself into trade associations and to require the companies in each of the various trade associations to regulate the particular line of industry in which they are engaged. A person or corporation engaged in non-competitive industry will not be affected. Two or more persons, companies or corporations engaged in the same line of commerce would be required to form a trade association —a body to which any other desirable name may be applied—and would then be required to regulate itself, by itself, and for itself.

This plan would provide for the association of industry into small units, and would allow these units to adapt themselves quickly to the ever-changing conditions in business. It is not unreasonable to assume that small units of individual industrial associations would be able to cope successfully and advantageously with the conditions over which they have jurisdiction. Making membership in trade associations mandatory and requiring them to regulate their own affairs would legalize the ends now sought by such associations, but which, under existing laws, are not permitted.

The organization of the Federal Trade Commission was probably intended as a step in this direction. Its usefulness starts and stops at the point of

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origin for the reason that it has no police powers and it is obvious that the enactment of legislation without means of enforcing that legislation is worse than useless. Furthermore, a federal bureau, organized to regulate all types of business, breaks down under its own weight and therefore is both inefficient and ineffective. A Federal Trade Commission, or federal bureau, can not function, however well organized, in regulating business as it should be regulated. Such an idea is a fallacy and has been proved so time and again. It is another glaring example of habit and tradition.

By permitting industry to regulate itself, and to organize itself into small units, we shall immediately wipe out the necessity of our so-called regulatory laws as they now exist with all their inequities. Such measures as the Sherman Act, Clayton Act, and similar regulatory efforts were predicated upon the premises that they were justified by the results which they were intended to produce and the benefits which were expected to follow their enactment. Under present conditions of business, in its far-reaching ramifications, such laws, in attempting to cover a great deal of ground and to be applicable in the regulation of business, are impractical for obvious reasons. They are not sufficiently adaptable to particular cases to provide the desired results. They are inelastic and non-applicable.

In a recent business magazine we read:

"Wool and Plumbing Institutes
Fail Through Lack of Support"

"The recent passing out of existence of Wool Institute, Inc. (New York) and National Plumbing and Heating Institute, Inc. (Chicago) marks the end of two vastly different types of coöperative effort under somewhat similar conditions. While each was well conceived as a constructive force in its special field, both have carried on under great difficulty, both have suffered from prevailing economic conditions, both emphasize in their respective obituary notices the fact that lack of moral support from the industry hastened their demise, both found that a federal agency contributed to their downfall. The first serious set-back was encountered when, early in 1930, the federal court enjoined the Wool Institute from activities directed to price maintenance, uniform openings, etc. In its valedictory bulletin the plumbing institute cites three major causes for its failure: (1) Lack of willingness to support long-term coöperative effort, (2) failure of the Federal Trade Commission to render assistance, (3) depression."

IF a sufficient number of business men are willing to use their influence in having Congress pass a law requiring the organization of institutes such as the wool and plumbing institutes and other similar trade associations and making membership obligatory, then there will be no splitting up of trade associations or institutes by their memberships. They will be required by law to coöperate to settle their differences by themselves and for themselves.

It is now optional whether a business shall become a member of a trade association or whether it shall not. If a certain industry is thus organized, there are a number of platitudes set forth which are all right so far as they go, but they are Utopian because they can not be enforced and therefore become useless. The way to correct this is to require the organization of all lines of industry into units. Those engaged in the manufacture of Portland cement would be required to become members of a Portland-cement manufacturers' association. Textile mills would be organized on the basis of the product they manufacture. Oil producers, steel producers, chemical manufacturers, lumber concerns, shoe manufacturers, the rubber industry, pottery, tile, glass, etc., would be put in their respective and proper groups. The law would then say to these manufacturers that they alone must control their industry and they will have no outside interference. They will be required to set up their own laws for the conduct of their affairs.

The law requiring the creation and maintenance of trade associations would at the same time provide a few other essential regulations, one of which would be that no member of any trade association would be allowed to sell his product at or below the cost of production. Furthermore, trade associations would be required to provide themselves with a uniform system of accounting and cost-keeping. The system of accounting would be left entirely in the hands of the trade association, so long as it was kept uniform for that association. The law making trade associations mandatory need not be much more extensive than herein outlined. It would, however, require the association to handle all disagreements that might arise within the association.

Failure of any association member to comply with the rules developed by the trade association would be handled by methods set up within and by the association. The law courts would have nothing whatever to do in this connection. The trade association would elect its own umpire, president, director or secretary, either from within or without its membership, and this directing head would have full authority and power to act as the final arbiter in all cases of controversy, in a manner prescribed by the association regulations. He would hold office only at the will and discretion of his association membership.

Such associations would be permitted by law to do the things that they are not now permitted by law to do. They would be permitted to curtail production, allot quotas, fix prices if necessary, exchange credit information, refuse to sell except on a cash basis to those who did not conform with the terms of sale of that particular group, regulate production by proper methods so as to conserve our natural resources for the benefit of the association membership and that of the public. They would be permitted by law to follow practices for the general benefit of industry which are now prohibited by present regulations.

The civil courts of the country would not be required to settle any disputes, as these would be settled within and by the membership. If some member of a trade association had reason to believe that some other member of that association

was violating any of the rules set up by the association, he would immediately notify the association director and, if necessary or advisable, would post a certain sum of money as representing good faith in his belief that the other member had violated certain rules. The director would immediately proceed to investigate, and if he found the accused member guilty he would return the money posted by the complainant and would have the power to impose, demand and collect a fine from the offender. The action would be almost immediate and certainly positive. The amount of the fine would be turned over to a central research department set up by the association. The research department would not be technical alone. It would be a department looking to the extension of markets seeking new uses and outlets for the industry's products, for the purpose of enlightening consumers regarding the articles produced by the association so the ultimate consumer would receive the maximum benefit from using the products of any association.

If this plan were effective to-day, the wool and plumbing institutes, along with numerous other trade bodies, would not cease to exist. They would maintain themselves in a healthy state.

In considering this plan a number of negative ideas suggest themselves. You are probably saying, among other things, that the public would be robbed, especially if it were legal for a certain group of manufacturers to fix prices, control production, allot quotas, etc. Keep in mind that the law of supply and demand can not be changed. It is as inexorable as the law of gravity. It may be that a certain trade association in working out its own salvation for the public welfare would inconvenience a certain number of people for a short period. The damage done and the suffering that might result would be insignificant as compared to the harm done and the suffering caused by the present depression, and other depressions that are bound to occur unless steps are taken to prevent them. What is desired is a method of utilizing the law of supply and demand. Therefore, trade associations when given the authority to regulate their own business, without any interference from the government, would mean the utilization of the law of supply and demand and would avoid the flood periods and drought periods in business which we now have.

Suppose, for example, that the cement industry, acting through its trade organization, should determine that the average cost of producing a barrel of cement is $4, and then it should decide to fix the selling price at, say, $20 per bbl. f.o.b. mill. What would result? Almost immediately the cement industry would place itself in practically the same position as it is in to-day. It would create a depression for itself, for the reason that no one would purchase cement. This would mean that the supply would be far in excess of the demand. Suppose the cement industry decided to "smoke out" the consumers by holding the price at $20 per bbl. This policy would quickly change for the reason that foreign-made cement, of good quality and prepared to meet all the engineering specifications, could be landed in this country at fair and reasonable prices, and quickly, too. Let us assume an exaggerated condition and say that no foreign-made cement could possibly be delivered in this country. Nothing very serious would happen. Some few might be inconvenienced for a short period. Any number of substitutes would quickly fill the place of Portland cement, and building would proceed in an orderly fashion, and the cement industry would quickly get in line. This is what would happen in all lines of industry if producers or manufacturers attempted to be unfair. The law of supply and demand operates for the protection of the public when permitted to do so. As a matter of fact no group of business men would permit an unsatisfactory condition to develop in their industry, if given the right to conduct their own affairs. Business men never rebel when given the right to proceed normally and orderly. They do rebel and should rebel when the laws compel them to become "industrial bootleggers."

Business men find suitable substitutes when some policy clearly indicates they can not proceed successfully with a given policy. Our man-made laws rarely even suggest a substitute, for in practically all cases they are developed from negative ideas, which makes necessary "industrial bootlegging" and other undesirable and destructive practices. This plan offers automatic protection to the public, because, as cited, the law of supply and demand can not be changed. It can be made usable for the benefit of all.

OUR present regulations do not protect the people of this country. If they did, we would not at this time be in the throes of the worst depression in history. Why not take the necessary steps to correct this condition? Industry, if given the opportunity, will quickly point the way.

Let us consider a little further some of the regulatory laws. More specifically, the Sherman Act was intended to correct an evil which was thought to exist at the time of its enactment and with the idea of precluding a further development of this supposed evil. In the light of subsequent events it is apparent that it has not served its purpose in a practical and satisfactory manner. It is generally conceded that the only real interpretation which can be applied to the Sherman Act is that no one knows how to interpret it. It has been variously interpreted by the courts; its meaning is obscure and entirely contingent upon judicial opinions at any given time. This being accepted, why permit such legislation to continue in effect?

Again quoting from Mr. Emery's recent address, "In the meantime a great body of supplementary federal legislation has modified and even repealed the application of the Sherman Act to a large volume of particular forms of business, and, in some fields, withdrawn the severer penalties of the original law from selected activities." This prompts us to ask, if the law can be repealed and modified in part, why not in its entirety?

The Capper-Volstead Act permits the coöpera-

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tion of one competitor with another in producing and distributing his product, provided that he is an agriculturist. The farmer, planter, fruit grower are permitted under this act to make agreements for the purpose of better distribution at prices that are intended to earn the producer a reasonable profit on his investment and efforts. Since agriculture in America is directly dependent upon industry for its prosperity, why therefore permit agriculture by law to regulate itself for its own benefit but at the same time, by another series of laws, preclude industry from being prosperous and thereby defeat the efforts of the agriculturists.

All the way through, we attempt to regulate at the end and not at the beginning. Our plan to-day seems to be, after the horse is stolen we lock the barn. Another way of illustrating this is to suppose that the officials of one of our larger cities should announce to its citizens that the city water-supply is polluted and that every time anyone drinks a glass of water it will be necessary to follow this with an antidote in order to safeguard health. The people of that particular city would immediately demand, and rightfully so, that the water be made wholesome and any deficiencies corrected at the source and not after the water is consumed. Regulating at the source is the natural procedure to follow and is carried out in practically everything except business. In business certain laws have been set up to regulate industry after it is "consumed" and not at the point of origin. This plan has been carried on so long that it is firmly fixed as habit and tradition. A solution is possible, namely, change our regulatory laws so that they will regulate at the beginning and not at the end. As a matter of fact, regulation can not be applied effectively at the end. The damage has already been done before regulation is applied and such regulation does not and can not overcome the damages of the laws set up to regulate at the end.

HOW best can our regulatory laws be made to function properly at the point of origin, and, so, result in eliminating the fallacy of present regulatory laws that are supposed to function but which do not? The solution seems practical and not at all unreasonable. We need only to follow certain regulations and laws that should be passed, and certain regulations that have been enacted and proved to be beneficial. Practical precedents have already been established and are now effective, if we only search them out and use them as a guide. For instance, in life insurance there is utilization of the law of supply and demand, and there is regulation that precludes destructive price-cutting and practically all unfair trade practices. It is said this is done because it affords protection to the people. There is no lack of healthy competition. We overlook the fact that life-insurance companies can not continue in business in this country unless we have successful industry, therefore why not let industry regulate itself as do the insurance companies? Banking is another example of the utilization of the law of supply and demand. Banking does not change the law one iota, it merely uses it. The base-ball industry is another example; and other cases could be cited.

In attempting to harness the law of supply and demand it should be kept in mind that it is just as much subject to control as the law of gravity, the laws of hydraulics, the laws of chemistry, physics, etc. It can be harnessed for the benefit of mankind. The real problem is to overcome the inertia of habit and tradition.

Newton told the world years ago something about the laws of gravity. When he did this he in effect overcame the inertia of habit and immediately set up the medium by which gravity could be put to work and made useful for mankind. In doing this he did not in any sense change gravity, he merely pointed out a way by which gravity could be made to serve useful purposes and thereby could be controlled to the extent of serving mankind. Gravity has always been gravity and will continue to be. Newton showed how it could be applied. It functions with mathematical accuracy and in accordance with definite laws. Newton did not create or change its occurrence, nor the laws that govern it—he merely showed how it could be made to work.

"Ol' man river, dat ol' man river,
He must know sumpin', but don't say nothin',
He just keeps rollin'
He keeps on rollin' along."

A number of us can remember when "ol' man river" would get out of control during different periods of the year and usually did a lot of damage. A song writer says that "Ol' man river, he must know sumpin', but don't say nothin'." As a matter of fact, old man river does know a lot and speaks out in unmistakable terms. A number of years ago he told the engineers that if they would provide ways and means for him to stay within reasonable bounds he would be willing to "keep on rollin'" and do a lot of useful work. Hydraulic engineers caught the message from "ol' man river" and as a consequence, a number of rivers have been harnessed, with the result we have fewer destructive floods, and, by harnessing the rivers, they have been made navigable, they generate energy for the use of man and these rivers are national benefactors. In doing this the inertia of habit was overcome. No change has been made in the volume of water; it has neither been increased or decreased; it is now being run by man and is not running man. The laws of hydraulics are inexorable, the same as the law of supply and demand.

For ages fire was a terrible menace; to-day it is a useful implement in the hands of man. This is because man regulates fire, and fire does not regulate man. In regulating fire, man does not change it one iota; fire is still the result of chemical combination. It proceeds in accordance with definite chemical and physical laws that can not be changed by man. Fortunately, however, man has learned to utilize and regulate the phenomena of chemistry and physics, one result of which is termed fire.

A plan in principle to conform to the suggestion

made here will not preclude a small concern from growing into a very large one, neither will it prevent a large and powerful corporation from becoming weak and ultimately "passing out of the picture." This plan simply means that the members of any association will be prohibited from engaging in destructive price-cutting, the wasting and dissipating of natural resources, overproduction, and trade practices that are recognized as being inimical to industry and to the public welfare.

ANYONE who desires to enter a competitive business can do so under this plan. He will have the right to go to the directing head of any trade association and secure all the data necessary for his proper guidance in arriving at a decision as to whether or not he then desires to enter that particular field. When he enters any particular industry he will simply be required to comply with the rules and regulations of that industry. He can not, however, sell at or below the cost of production, and he must, upon receiving his charter permitting him to engage in business, make immediate application for membership in the trade association governing his particular activity. Under no circumstances will he be refused membership.

This plan, if carried through, would mean that the association director would accumulate, by suitable means, all the data necessary properly to guide the activities of his association, and these data would be submitted annually, or oftener if desired, to the federal government for its information.

Each trade association would provide its own research bureau, each member contributing a certain percentage of his sales for the proper maintenance of the central research department. There would be a free and unhampered exchange of information. If some industry were to secure a patent, every other member of the association would be allowed to use that patent if he should so desire, but would be required to pay royalty to the patentee. This whole plan may sound quite radical, however it is believed to be fundamentally sound and correct, and will result, if carried through, in utilizing the law of supply and demand and thus prevent further serious depressions.

The fact that the law of supply and demand is inexorable does not preclude its being harnessed and thereby made useful and practical for the benefit of mankind. How then can the start be made?

1. Accept the law of supply and demand as being inexorable.

2. Accept the fact that the law of supply and demand can be utilized for the benefit of all.

3. Accepting the fact that the first two are true, then the business men of this country should start immediately to put these facts into effect.

"Tolerance is different from indifference. Tolerance is a positive thing. It is ability to endure ideas you don't like. Intolerance hates change and new ideas, and the only hope of proper adjustment of a society is that that society will have enough tolerance not to throttle efforts at change."

The Foreman's Safety Responsibility

(Continued from page 58)

I realize that it is rather difficult to lay down a set of definite methods to govern each job in our company but I feel that sometimes the carrying out of definite methods in doing various jobs is not as hard as it seems at first glance. My suggestion for foremen is that we let them endeavor to picture each job to be done with the following features in mind:

1. A review of instructions covering the job.

2. Selection and placement of the human element for the job.

3. A careful check on materials, tools, equipment and protective devices.

4. The issuance of full and detailed instructions to each employee as to the methods to be followed in doing each part of the job, with proper emphasis on safety and the use of protective devices.

5. A close direction of all details of the work to detect improper methods, best methods, and the safest methods.

6. A consciousness that the responsibility for the successful and safe execution of the work at hand is the foreman's responsibility and that excuses and indifference will not be tolerated.

Poor judgment is another source of accidents. Good judgment is the faculty of deciding correctly, while poor judgment is just the reverse. With poor judgment comes mistakes and in our industry too many mistakes can not be made, particularly in dealing with electric currents.

A partial antidote for poor judgment is more concentration and attention to a job on the part of employees and foremen. A person in this industry, regardless of his position, should know that he has no business to be day-dreaming while doing a piece of work. Thinking at all times is necessary if mistakes are to be avoided. An employee who can not measure up to the proper qualifications after a training period surely has no place in the utility business for his own, his foreman's and the company's best interest.

It is not always possible for the foreman to do all the thinking for his men, nevertheless, he must do a good portion of it. This is simply part of his job and it will be with him as long as he is foreman. What the men lack in thinking ability and judgment the foreman must supply.

Next year, when we come to analyzing the accidents which took place in 1931, I hope that we will find less to talk about than we did this year. I wonder whether we will again have before us the three great causes of accidents: violation of rules, improper methods, and poor judgment?

Right now is the time for each foreman to check up on himself and on his men to determine whether everyone is in harmony with the idea of preventing accidents. Next week or next month may be too late, for someone may be the victim in the meantime.

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Is There Any Mystery About Producing Quick-Hardening Cements?

By AMAN MOORE

President, Cement Securities, Ltd.

IN a recent article in a trade journal a statement was made to the effect that the secrecy surrounding the manufacture of quick-hardening Portland cement should be removed. The object of this article is to remove that mystery. The process of manufacturing quick-hardening Portland cement should involve no secrecy and is the most simple process possible. Briefly, it is the securing of a combination of lime with silica and lime with alumina in such proportions that there will be 3 atoms of lime to 1 atom of silica and 3 atoms of lime to 1 atom of alumina, the resulting product being called tricalcium silicate and tricalcium aluminate. There is also a third compound, calcium-ferro-aluminate, wherein both iron and alumina combine in a fixed ratio with lime to produce a compound which is also an important factor in assisting in the process of fusing the different elements at a comparatively low temperature.

The important thing in the process of making a quick-hardening Portland cement is the ability to add the theoretical amount of lime to the raw mix so as to produce a maximum amount of tricalcium silicate and tricalcium aluminate plus calcium-ferro-aluminate. The object is to eliminate the dicalcium as completely as possible. If any dicalcium remains after the clinker is burned, it is because of the inability to clinker it under proper conditions so that it becomes a tricalcium instead of a dicalcium, or, the raw mix is not perfect. With the ordinary short length kilns and with no soaking zones it is impossible to hold the material back in the hot-burning zone of the kiln sufficiently long to permit 3 atoms of lime to combine with 1 atom of silica and 3 atoms of lime to combine with 1 atom of alumina completely, and to allow the required amount of lime to combine properly with the alumina and iron to produce a calcium-ferro-aluminate.

With the use of short kilns, without soaking zones, the ordinary method in the past has been to reduce the lime content to a point below the theoretical requirement; otherwise the mixture, passing through a short kiln under improper conditions, to obtain perfect chemical action would produce a large percentage of the dicalcium, and an extra atom of lime, intended to combine with the dicalcium portion to make all tricalcium, would remain as free lime and, hence, the result would be an unsound cement. Naturally under such conditions the only remedy that a chemist could apply would be the reduction of lime below the theoretical required content in order to avoid an unsound cement. The point I wish to make is that, only by having long kilns and soaking zones, can a perfect cement clinker be secured with only one burning. When a perfect cement clinker is secured, it will require the theoretical amount of lime in the raw mix. With such a raw mix—burned under the proper conditions with sufficiently-long kilns and with soaking zones to hold the mix back while passing through the white-hot zone, permitting a perfect chemical action to take place—then the dicalcium will be almost, if not entirely, eliminated by conversion into tricalciums, as it should be. Emphasizing this point, I mean to say that all the dicalcium is more or less an adulterant, and, hence, the slow-acting Portland cement that we have had in the past. With a perfect burning in long kilns and with proper soaking zones, or by multiple burning in short kilns, thereby completely eliminating the dicalcium and producing only three main compounds—tricalcium silicate, tricalcium aluminate and calcium-ferro-aluminate—we would have a perfectly-burned clinker which, when ground to proper fineness, would yield a quick-hardening Portland cement.

The word "quick-hardening" is a misnomer; the word, "near-perfect" Portland cement should be substituted therefor. While the long kilns are a large factor in the production of a "near-perfect" Portland cement, it is absolutely essential to have a near-perfect raw mix. Such a near-perfect raw mix constitutes a 3- or 4-way mix. The ratio of the iron to the alumina and that of the iron plus the alumina to the silica are just as essential as the ratio of the silica, alumina and iron to the lime. The addition of iron ore, or the use of clay or shale heavy in iron content, is very desirable. The iron seems to assist in the fluxing and the compound of calcium-ferro-aluminate seems to be a very important factor in the production of a quick-hardening or near-perfect Portland cement. The amount of iron can be almost or fully equal to the amount of alumina; while the iron plus the alumina multiplied by from 1.6 to 2 seems to be the best ratio to the silica. However, ratios higher than 2 to 1 can be used successfully, with correspondingly less iron and alumina present; by increasing the lime proportionately, but it will require higher temperatures in the kiln to clinker the mix. Under such conditions the tricalcium silicate will be increased, with a corresponding decrease in the tricalcium aluminate and the calcium-ferro-aluminate. Some cements have a ratio as low as 1.6 to 1, that is, the iron plus the alumina multiplied by 1.6 equals the silica. One well-known brand of white Portland cement has a ratio of 4.1, which means that the iron plus the alumina multiplied by 4.1 equals the silica. The higher the ratio of the iron plus the alumina to the silica, the greater the temperature required

properly to burn the clinker. A temperature of approximately 3,300 deg. F. partly destroys the tricalcium combination with silica and, hence, when the ratio of silica to the iron plus the alumina is too great, so that the temperature nears 3,300 deg. F., it has a tendency to break down at least a large portion of the tricalcium, thereby lowering the strength of the cement and reducing its quick-hardening properties. On the other hand, if the alumina content is too high and the silica content too low, it has a tendency to "flash set" and, hence, requires the addition of too much gypsum as a retarder. Furthermore, the clinker is very hard to grind and requires the consumption of much more power in grinding it to the proper fineness. The best practice is to hold the ratio of the silica to the iron plus the alumina at a point somewhere near 2 and above 1.6. Such ratios keep the temperature in the kilns, while vitrifying the clinker, at a point approximately 2,450 to 2,600 deg. F. When the iron content is somewhere near half and half with the alumina content, then an easily-ground, bird-shot, clinker is produced. The cement under such conditions is extremely quick-hardening and answers the description near-perfect.

In order to set forth more clearly these facts, I shall give: (1) Analyses of seven Portland cements; (2) analyses of three white Portland cements; (3) probable constituents of the seven brands of Portland cement; (4) probable constituents of the three white Portland cements; (5) total tricalciums plus calcium-ferro-aluminate in the ten brands of Portland cement; and (6) the ratio of the iron plus the alumina to the silica in the ten brands of Portland cement.

Some years ago, about 1922 and 1923, Hans Olson of Los Angeles experimented by burning cement clinker. After regrinding it from the first burn, he reburned it, and then repeated this operation of alternate burning and regrinding a multiple number of times. The extra cost of the double burning, in order to produce a quick-hardening Portland cement, when burning the clinker in short kilns, is considerable. My contention is that, with sufficiently-long kilns and with soaking zones, a near-perfect Portland cement, which is quick-hardening in action, will be secured with only one burning instead of two or more. The assumption, of course, is based on the securing of a perfect and theoretically correct mix of the raw materials entering into the long kiln at the feed end. With such a theoretically correct mix entering into the long kiln at the feed end, and with normal operation of the kiln, the resulting clinker is bound, when ground to approximately 200-mesh, to result in a near-perfect Portland cement that will secure almost its full strength in 24 to 48 hr., or within a few days or longer. The lime content of such a cement will be somewhat higher than is carried in the average ordinary Portland cement of to-day. Such cement, when used in concrete, will show no deterioration and will increase in strength over an indefinite period, and the strength of the concrete, so produced, will be much greater than if ordinary, slow-hardening Portland cement had been used instead of the near-perfect Portland cement.

I. Analyses of Seven Portland Cements.

	No. 1 (California) %	No. 2 (California) %	No. 3 (California) %	No. 4 (California) %	No. 5 (Alabama) %	No. 6 (California) %	No. 7 (California) %
Silica	22.60	22.00	20.20	21.20	19.60	21.20	18.89
Alumina	5.82	5.36	6.20	5.40	8.04	6.23	6.55
Iron oxide	2.00	2.11	3.50	2.79	4.20	4.37	4.74
Lime	63.20	63.20	63.20	64.20	64.45	65.74	65.41
Magnesia	3.02	2.10	2.16	1.08	.90	.60	1.61
Sulphate anhydride	1.71	1.54	2.05	2.05	1.90	1.18	1.30
Loss	1.02	2.14	1.66	2.04	.90	.68	.90
Total	99.37	98.45	98.97	98.76	99.99	100.00	99.40

II. Analyses of Three White Portland Cements.

	(California) %	No. 1 (United States) %	No. 2 (United States) %
Silica	20.80	23.56	24.66
Alumina	10.10	5.66	5.60
Iron oxide	.32	.32	.38
Lime	65.50	64.12	61.87
Magnesia	.58	1.54	1.90
Sulphate anhydride	1.35	1.50	1.51
Ignition loss	.60	2.92	3.84
Total	99.25	99.62	99.76

III. Probable Constituents of the Seven Brands of Portland Cement.

	No. 1 %	No. 2 %	No. 3 %	No. 4 %	No. 5 %	No. 6 %	No. 7 %
Tricalcium silicate	32.89	41.00	47.10	49.48	43.21	50.44	71.85
Dicalcium silicate	41.42	33.55	23.43	24.61	24.77	23.89	00.00
Tricalcium aluminate	12.05	10.65	10.51	9.61	14.23	9.13	9.35
Calcium-ferro-aluminate	6.07	6.40	10.63	8.47	12.75	13.27	14.39
Magnesia	3.02	2.10	2.16	1.08	.90	.60	1.61
Calcium sulphate	2.90	2.61	3.48	3.48	3.23	2.00	1.30
Ignition loss	1.02	2.14	1.66	2.04	.90	.73	.90
Total	99.37	98.45	98.97	98.77	99.99	100.06	99.40

IV. Probable Constituents of the Three Brands of White Portland Cement.

	(California) %	No. 1 (United States) %	No. 2 (United States) %
Tricalcium silicate	31.10	36.65	17.38
Dicalcium silicate	37.49	40.54	58.73
Tricalcium aluminate	26.23	14.46	14.20
Calcium-ferro-aluminate	.97	.97	1.15
Magnesia	.58	1.54	1.90
Calcium sulphate	2.29	2.55	2.56
Ignition loss	.60	2.92	3.84
Total	99.26	99.63	99.76

V. Total Percentage of Tricalciums Plus Calcium-Ferro-Aluminate in the Ten Brands of Portland Cement.

	Tricalcium Silicate %	Tricalcium Aluminate %	Calcium-ferro-aluminate %	Total Tricalciums Plus Calcium-ferro-aluminate %
1. California No. 7	71.85	9.35	14.39	95.59
2. California No. 6	50.44	9.13	13.27	72.84
3. Alabama No. 5	43.21	14.23	12.75	70.19
4. California No. 3	47.10	10.51	10.63	68.24
5. California No. 4	49.48	9.61	8.47	67.56
6. California White	31.10	26.23	.97	58.30
7. California No. 2	41.00	10.65	6.40	58.05
8. U. S. White No. 1	36.65	14.46	.97	52.08
9. California No. 1	32.89	12.05	6.07	51.01
10. U. S. White No. 2	17.38	14.20	1.15	32.73

VI. The Ratio of Iron Plus Alumina to the Silica in the Ten Brands of Portland Cement.

1. Alabama No. 5 ..... 1.60
2. California No. 7 ..... 1.673
3. California White 2.00
4. California No. 6 ..... 2.00
5. California No. 3 ..... 2.08
6. California No. 4 ..... 2.30
7. California No. 2 ..... 2.60
8. California No. 1 ..... 2.89
9. U. S. White No. 1 ..... 3.94
10. U. S. White No. 2 ..... 4.12

CAN carbon dioxide be recovered from cement kilns economically? Mr. Moore discusses this possibility in another article to be published shortly.

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MEN OF THE INDUSTRY

The portrait printed on this page in each number of PIT AND QUARRY is selected without significance as to current events or the position of the individual in the industry.

Photo by Blank-Stewar, Inc.

G. B. WOOD

President

Portland & Rockport Lime Corp.

Rockland, Me.

Coming Events

Nov. 12, 1931. St. Louis, Mo. Monthly meeting, St. Louis Quarrymen's Assn., Forest Park Hotel. E. J. McMahon, exec. sec., 4063 Forest Park Blvd., St. Louis, Mo.

Jan. 9-15, 1932. Detroit, Mich. Annual Convention and show, American Road Builders' Assn. Chas. M. Upham, engineer-director, National Press Bldg., Washington, D. C.

Jan. 19-22, 1932. Pittsburgh, Pa. Annual Convention, National Crushed Stone Assn., Wm. Penn Hotel. J. R. Boyd, secretary, Merchandise Bldg., Washington, D. C.

Jan. 25-26, 1932. Pittsburgh, Pa. Annual convention, National Ready-Mixed Concrete Assn., Wm. Penn Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Jan. 27-29, 1932. Pittsburgh, Pa. Annual convention, National Sand & Gravel Assn., Wm. Penn Hotel. V. P. Ahearn, executive secretary, Munsey Bldg., Washington, D. C.

Feb. 3-4, 1932. Washington, D. C. Annual meeting, Sand-Lime Brick Assn. Ellen Knight, sec., 321 N. Hamilton St., Saginaw, Mich.

Feb. 23-26, 1932, Wichita, Kan. Seventh Annual Southwest Road Show and School.

Feb. 23-26, 1932. Washington, D. C. Annual convention, American Concrete Institute, Wardman Park Hotel. Harvey Whipple, sec., 2970 West Grand Blvd., Detroit, Mich.

Pumpings from the Old Pit

Excerpts from the old files of PIT AND QUARRY *reveal many interesting sidelights on the activities of the pits, quarries and plants of former days. These are printed in this column each issue.*

Fifteen Years Ago

THE plant of the National Limestone Co., located two miles from Martinsville, W. Va., was sold to Clarence L. Peaslee and W. W. Jackson of Williamsport, Pa., James S. McAnulty of Scranton, Pa., and U. M. Fells of Towanda, Pa. The consideration was said to be $200,000.

* * *

The Mackinaw Sand & Gravel Co. of Lincoln, Ill., installed its third plant at Decatur, Ill. Officers and directors of the concern were J. W. McGrath, T. E. McGrath, T. L. Blackburn, Fred. F. Longan and Dean Hill. Modern washing and screening equipment was featured.

* * *

Ten Years Ago

ANNOUNCEMENT was made by the National Lime Assn. of the appointment of Peter C. Spence as manager of the construction-lime department. Mr. Spence had been identified with the building industry in New York for many years.

* * *

At a conference of Mid-west quarrymen, it developed that 35 per cent. of the output in 1921 of those attending was shipped by motor trucks. Five years before, in 1916, only 5 per cent. was transported from the plants by truck. Excessive freight rates prevailing at the time were said to be the principal cause for the increase.

* * *

The Ralph Gypsum Co. of LeRoy, N. Y., elected the following officers: George J. Ralph, president; George W. Miller, vice-president; Edward H. Hunt, secretary; and Joseph Voegele, treasurer.

* * *

Five Years Ago

AT the Fifteenth Annual Safety Congress held at Detroit, Mich., the following officers were named by the Quarry Section for the next year: L. R. Cartwright, Midwest Crushed Stone Co., chairman; Don C. Souder, France Stone Co., vice-chairman; and A. C. Hewitt, American Lime & Stone Co., secretary.

* * *

Railroads were handling an unprecedented amount of freight revenue, loading for the week ended October 23, 1926, totalling 1,209,043 cars. Loadings for the entire year up to that date had never dropped below one million cars.

* * *

New incorporations in the industry included the following: Blue Diamond Co. of Washington, $2,100,000; Arrowhead Gravel & Sand Co., Plattin, Mo., $100,000; Coogan Gravel Co., Peoria, Ill., $75,000; Penn Limestone Co., Kutztown, Pa., $100,000.

Furnishes Conveyors for Hoover Dam Gravel Plant

An order for 1½ miles of belt conveyors has been received by the Stearns Conveyor Co. of Cleveland, a subsidiary of the Chain Belt Co., Milwaukee, for construction work on the Hoover Dam. The order consists of approximately 1,200 troughing and return idlers. These idlers will be of the Rex-Stearns unit casting closed-head type, especially designed for the severe handling service represented by the crushed-stone and gravel industry. Thirty-inch belts and smaller will be built in the 3-pulley type of construction and 36-in. and 42-in. sizes will be furnished in the 5-pulley type of construction. The gravel plant at Hoover Dam, which is to prepare the aggregates for later construction, will be located at Boulder City, Nev., and will, during the course of the construction work on the dam, handle approximately 8,000,000 tons of sand and gravel. Rex-Stearns rubber-covered idlers will be used at the loading points to reduce belt wear to a minimum.

Ohio Geological Survey Reinstated by Governor

To the Editor:

I am pleased to pass on to you the news that the Governor and the State Board of Control have reinstated the Geological Survey of Ohio by providing funds for 1932. The amount appropriated is sufficient to keep the organization intact and to continue some of the work now in progress.

I wish to take this opportunity to thank you for your help in bringing about the restoration of our survey. Your editorial was certainly to the point. Indeed we sent the clipping to the president of the Board of Control.

GEOLOGICAL SURVEY OF OHIO,
Wilbert Stout, *State Geologist.*
Columbus, O.

New Corporations

TENNESSEE VALLEY SAND & GRAVEL CO. OF TENNESSEE, Shellmound, Tenn. $25,000. L. E. Wilson, W. M. Thompson and Claude Smith, Jr.

NEBRASKA GRAVEL & STONE CO., Omaha, Neb. $25,000. Emil E. Placek, 919 S. 15th St.; Carl Manska, 2741 N. 60th St.; Joseph T. Votava.

SEQUOYAH MARBLE CORP., Fort Smith, Ark. Charles E. Jenks and James W. Hicks, both of Carthage, Mo. To develop marble and stone quarries in western and northwestern Arkansas.

OAK HILL LIME & STONE CO., State College, Pa. $5,000. H. O. Smith.

AKRON CONCRETE PRODUCTS CORP., Akron, O. 500 sh. pref. @ $100.00 and 2,500 sh. n.p.v. Lewis E. Bratt, Robert S. Mills and Charles H. Blackmore.

QUIMBY INTERLOCKING CAST STONE CO., Houston, Tex. C. F. Fleming, 7121 Harrisburg Blvd.

GIBRALTAR CEMENT PRODUCTS CORP., Hackensack, N. J. $125,000. Charles Turndorf.

Personal Mention

Harvey G. Mead, proprietor of the Felton Sand & Gravel Co., of Felton, Cal., has sold the plant to **R. M. Greathouse** of Oakland. Mr. Greathouse was formerly president of the G. & M. Gravel Co. of Felton before the company sold out to the Pacific Coast Aggregates, Inc. For the past two years he has devoted his time in the developing of a silica deposit near Brentwood, Cal. His company, known as the Silica Co. of California, is now supplying silica sand to the glass industry in San Francisco and Oakland.

Richard Uhlig has been made general superintendent, effective October 1, of the Missouri Portland Cement Co. Mr. Uhlig will maintain his office at the headquarters of the company in the Telephone Bldg., St. Louis, Mo.

C. H. Upson, 1012 Traction Bldg., Cincinnati, O., has been appointed representative in that territory by the Union Chain & Manufacturing Company, Sandusky, O. Mr. Upson has had wide experience in the field of power-transmission, elevating and conveying, and is particularly well fitted to represent the company and serve the users of silent, roller and other power transmission, elevating and conveying chains which it manufactures.

Roy Wilcox, president of the Wilcox Sand & Gravel Co. of Grants Pass, Ore., has purchased the Grants Pass Concrete Construction Co. The chief activity of the newly-acquired concern is the production of concrete building units.

E. R. Dougherty has joined the American Manganese Steel Co. sales organization, and will work with **E. F. Mitchell**, district manager, in the engineering and sale of Fahralloy castings in Chicago and the surrounding territory. Mr. Dougherty has had considerable experience in this work, and is familiar with problems of the application of castings for high-temperature and corrosion services, and their solution. He is now a member of an organization with many years' experience with these alloys, together with adequate metallurgical, engineering and production facilities, and personnel to serve all of your needs.

Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research, Pittsburgh, Pa., has announced the foundation of an industrial fellowship by the Green Bag Cement Co. of Pittsburgh, subsidiary of the Davison Coke & Iron Co. The investigational work of this fellowship, which will be carried on by **Raymond C. Briant**, will be concerned with studies of the chemical and physical properties of Portland cement and with the development of certain new cement products. Mr. Briant comes to Mellon Institute from the United States Bureau of Standards, Washington, D. C., where, during the past several years, he has been engaged in research under the auspices of the Portland Cement Assn. He was previously employed in the Portland cement industry of eastern Pennsylvania, following the completion of his chemical engineering education at Lafayette College.

W. K. Hunter, chemical engineer of the Williams Lime Co. of Knoxville, Tenn., reports the development of a new high-calcium finishing lime by his company. The new material has not been entirely perfected but indications are that it will be highly plastic and will carry more sand than most of the lime now used for that purpose, according to Mr. Hunter.

Obituary

Frederick A. Boeye, vice-president and general sales manager of the North American Cement Corp., died October 4 at his home in New York, N. Y. Mr. Boeye was apparently well on the road to recovery from a nervous breakdown which he suffered several months ago and his death came as a shock to his many friends in the industry. He was 47 years of age and had been connected with the North American organization for the last six years. Previously he had been associated with the Atlas Portland Cement Co., which has since been consolidated with the Universal Company as The Universal-Atlas Cement Co. Since January of last year, Mr. Boeye had been chairman of the committee on advertising of the Portland Cement Assn. His loss is most keenly felt by the North American company, where he had been guiding the affairs of the concern during the long illness of its president, F. W. Kelley. Mr. Boeye is survived by the widow. He had no children. Burial took place at Webster City, Ia., his birthplace.

Frederick A. Boeye.

Albert Jefferson Sayers, noted Link-Belt engineer, 61 years old, passed away at his home in Chicago recently. Mr. Sayers was head of the coal-tipple and coal-washery department of Link-Belt Co., Chicago. He was well known throughout the industry, having designed and built numerous plants for the handling and preparation of coal, in all parts of the country, and was recognized as one of the leading designers of this type of equipment.

Born September 10, 1870, at Troy, O., and educated at the University of Illinois, he was graduated in the class of 1895. He joined the Link-Belt organization in 1899. Mr. Sayers is survived by his widow, Mrs. Mabel J. Sayers; his son, Robert P.; and a daughter, Edith E. Sayers.

Chapin A. Day, 76, president and founder of the Utah-Idaho Portland Cement Co. of Ogden, Utah, died October 15 following a short illness. Mr. Day had been in poor health for about a month. He was born in Blue Island, Ill., January 5, 1855. After being graduated from high school he took a position with the Natural Cement Co. of Utica, Ill. Not long after this he entered a Utica bank, where he worked for two years. After leaving the banking business, Mr. Day spent two years in the commission business, following which he entered the service of the Field-Leiter Co., afterwards Marshall Field & Co., where he remained for 35 years, rising to the position of treasurer. After retiring from the mercantile business in 1911, Mr. Day came to Ogden, where he organized the Ogden Portland Cement Co., with a plant in Brigham City, Utah, which later became the present Utah-Idaho Portland Cement Co.

E. M. Poston, vice-president and director of the Wellston Iron Furnace Co., operator of a cement plant at Superior, O., died at his home, Columbus, O., October 9. Mr. Poston was 69 years old. Death resulted from diabetes after an illness of a week's duration.

Latest Portland-Cement Statistics

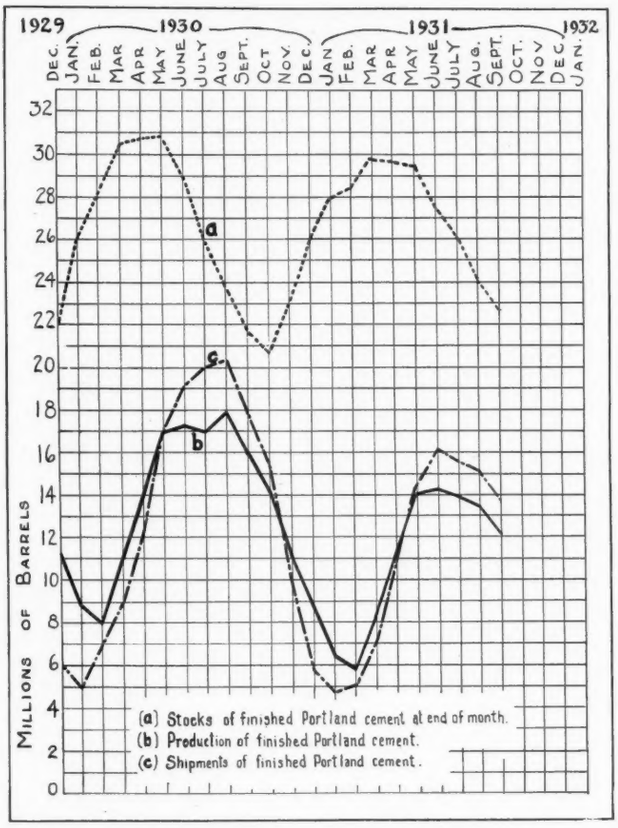

1929
1930
1931
1932
DEC. JAN. FEB. MAR APR MAY JUNE JULY AUG SEPT. OCT NOV DEC. JAN FEB. MAR APR MAY JUNE JULY AUG. SEPT. OCT. NOV DEC. JAN.
MILLIONS OF BARRELS
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32
a
b
c
(a) Stocks of finished Portland cement at end of month.
(b) Production of finished Portland cement.
(c) Shipments of finished Portland cement.

Chart showing production, shipments and stocks on hand, by months, from December, 1929, to September, 1931.

THE PORTLAND-CEMENT INDUSTRY in September, 1931, produced 12,092,000 bbl., shipped 13,671,000 bbl. from the mills and had in stock at the end of the month 22,734,000 bbl. Production of Portland cement in September, 1931, showed a decrease of 25.0 per cent. and shipments a decrease of 24.4 per cent. as compared with September, 1930. Portland-cement stocks at the mills were 3.9 per cent. higher than a year ago. The total production for the nine months ending September 30, 1931, amounts to 99,673,000 bbl., compared with 126,917,000 bbl. in the same period of 1930, and the total shipments for the nine months ending September 30, 1931, amounts to 102,807,000 bbl., compared with 128,673,000 bbl. in the same period of 1930. The statistics here presented were compiled by the U. S. Bureau of Mines.

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN AUGUST, 1931

Imported from—	District into which imported	Barrels	Value
Belgium	Porto Rico	4,011	$ 4,727
Canada	Maine and New Hampshire	36	111
Cuba	Maryland	4,000	6,000
France	New York	865	1,665
Japan	Hawaii	848	901
	Total	9,760	$13,404

DISTRIBUTION OF CEMENT

Shipped to—	July		August	
	1930	1931	1930	1931
Alabama	137,184	93,076	106,464	88,251
Alaska	1,774	2,716	4,465	1,666
Arizona	34,382	41,979	51,855	37,842
Arkansas	184,255	110,421	165,886	82,714
California	846,508	540,476	868,795	521,774
Colorado	92,898	73,107	106,576	77,569
Connecticut	191,178	166,381	205,553	159,855
Delaware	68,752	42,710	47,898	30,933
District of Columbia	87,492	126,637	126,581	122,153
Florida	105,993	107,090	85,673	68,905
Georgia	147,652	159,180	186,694	191,428
Hawaii	18,164	23,770	19,301	20,407
Idaho	51,059	22,930	52,084	23,842
Illinois	1,495,891	1,054,935	1,604,378	1,063,517
Indiana	864,425	682,234	686,122	592,825
Iowa	1,184,588	681,197	1,077,919	563,562
Kansas	226,827	198,757	271,491	242,108
Kentucky	223,147	201,975	265,288	185,402
Louisiana	308,306	512,964	235,564	498,824
Maine	95,005	86,427	128,866	75,516
Maryland	274,298	186,573	314,239	161,645
Massachusetts	324,874	377,774	328,187	332,816
Michigan	1,253,055	908,045	1,269,546	787,425
Minnesota	647,064	681,655	602,931	668,690
Mississippi	66,721	69,260	96,483	67,290
Missouri	737,463	427,289	770,346	466,196
Montana	37,429	32,722	36,407	34,859
Nebraska	210,545	281,405	226,618	319,336
Nevada	15,694	9,774	14,645	9,907
New Hampshire	80,647	63,680	81,651	78,995
New Jersey	788,857	519,732	709,844	550,716
New Mexico	31,722	21,853	36,680	20,056
New York	2,474,955	2,415,239	2,596,407	2,548,291
North Carolina	108,620	126,608	116,028	77,320
North Dakota	53,178	31,587	31,984	22,552
Ohio	1,294,504	869,396	1,286,700	700,988
Oklahoma	362,973	226,890	360,766	311,923
Oregon	116,047	102,903	114,400	93,759
Pennsylvania	1,915,236	807,513	1,912,983	869,155
Porto Rico	8,250	5,595	4,500	4,035
Rhode Island	66,903	57,157	83,057	59,797
South Carolina	185,517	175,332	236,649	141,224
South Dakota	82,598	101,420	72,829	95,711
Tennessee	267,623	100,770	285,916	106,227
Texas	644,850	588,163	605,660	562,895
Utah	38,485	42,650	44,554	24,194
Vermont	112,145	48,958	104,324	56,224
Virginia	182,631	178,952	179,227	146,156
Washington	330,911	265,116	341,647	223,760
West Virginia	199,923	179,975	216,018	166,437
Wisconsin	810,875	611,166	842,250	712,588
Wyoming	23,380	20,863	20,642	15,674
Unspecified	0	47,943	20,373	61,143
	20,113,423	15,512,920	20,261,944	15,147,077
Foreign countries	39,577	32,080	37,056	24,923
Total shipped from cement plants	20,153,000	15,545,000	20,299,000	15,172,000

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN AUGUST 1931

Exported to—	Barrels	Value
Canada	2,360	$ 7,613
Central America	10,991	20,367
Cuba	2,743	7,176
Other West Indies and Bermuda	1,473	3,298
Mexico	3,848	11,322
South America	15,701	43,567
Other Countries	2,401	13,300
Total	39,517	$106,643

RELATION OF PRODUCTION TO CAPACITY

	September		August 1931 (per cent.)	July 1931 (per cent.)	June 1931 (per cent.)
	1930 (per cent.)	1931 (per cent.)			
The month	75.7	55.3	60.2	62.0	65.4
The 12 months ended	65.2	50.2	52.0	53.8	55.2

UNIVERSITY OF MICHIGAN LIBRARIES

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1930 AND 1931 (*In thousands of barrels*)

Month	Production		Shipments		Stocks at End of Month	
	1930	1931	1930	1931	1930	1931
January	8,498	6,595	4,955	4,692	27,081	27,759
February	8,162	5,920	7,012	5,074	28,249	28,612
March	11,225	8,245	8,826	7,192	30,648	29,676
April	13,521	11,245	13,340	11,184	30,867	29,715
May	17,249	14,010	17,224	14,200	30,891	29,554
June	17,239	14,118	18,781	16,077	29,364	27,602
July	17,078	13.899	20,153	15,455	26,289	25,934
August	17,821	13.549	20,299	15,172	23,824	24,313
September	16,124	12,092	18,083	13,671	21,889	22,734
October	14,410	.....	15,599	.....	20,697	.....
November	11,098	.....	8,784	.....	23,056	.....
December	8,480	.....	5,688	.....	25,838	.....
Totals	160,905	.....	158,744	.....	.....	.....

PRODUCTION AND STOCKS OF CLINKER, BY DISTRICTS, in SEPTEMBER 1930 and 1931 (*in thousands of barrels*)

District	Production		Stocks at End of Month	
	1930	1931	1930	1931
Eastern Pa., N. J., and Md	2,919	2,417	1,292	936
New York and Maine	1,180	987	453	315
Ohio, Western Pa., and W. Va	1,622	822	752	876
Michigan	1,006	464	800	555
Wis., Ill., Ind., and Ky	1,665	1,276	878	532
Va., Tenn., Ala., Ga., Fla., and La	1,197	1,078	925	720
Eastern Mo., Ia., Minn., and S. Dak	1,627	1,168	490	545
W. Mo., Neb., Kan., Okla., and Ark	1,194	691	258	456
Texas	653	576	279	274
Colo., Mont., Utah, Wyo., and Idaho	291	109	302	196
California	861	502	961	1,230
Oreg. and Wash	362	324	393	296
Totals	14,577	10,414	7,783	6,931

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN SEPTEMBER, 1930 AND 1931, AND STOCKS IN AUGUST 1931 (*in thousands of barrels*)

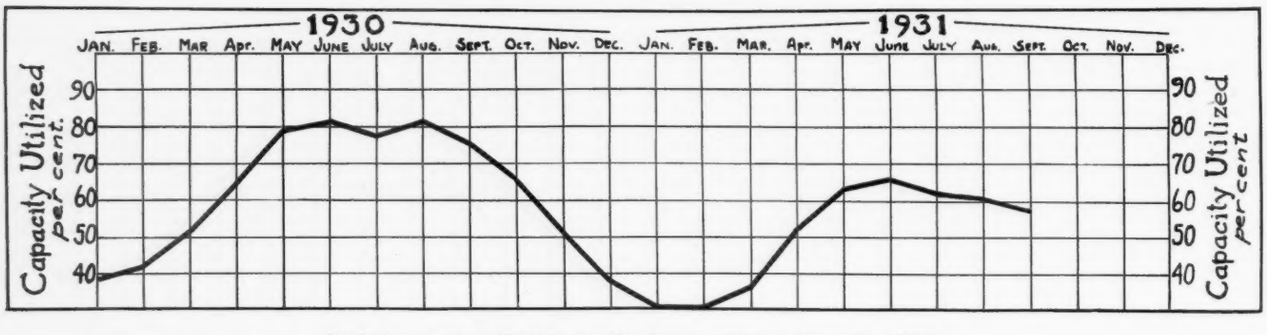
District	September						Stocks at End of August 1931
	Production		Shipments		Stocks at End of Month		
	1930	1931	1930	1931	1930	1931	
Eastern Pa., N. J., and Md	3,273	2,761	3,813	3,108	4,966	5,422	5,769
New York and Maine	1,238	1,292	1,467	1,500	1,069	1,280	1,489
Ohio, Western Pa., and W. Va	1,873	1,063	1,984	1,224	3,079	3,344	3,505
Michigan	1,242	743	1,381	807	2,279	1,912	1,975
Wis., Ill., Ind., and Ky	2,171	1,623	2,716	1,995	2,751	2,648	3,020
Va., Tenn., Ala., Ga., Fla., and La	1,198	1,069	1,178	1,032	1,814	1,725	1,687
Eastern Mo., Ia., Minn., and S. Dak	1,748	1,228	2,116	1,341	1,569	2,361	2,474
W. Mo., Neb., Kan., Okla., and Ark	1,233	701	1,227	886	1,643	1,305	1,490
Texas	679	625	599	688	707	539	603
Colo., Mont., Utah, Wyo., and Idaho	260	171	258	224	508	532	585
California	806	529	905	593	1,020	1,050	1,114
Oreg. and Wash	403	287	439	273	484	616	602
Totals	16,124	12,092	18,083	13,671	21,889	22,734	24,313

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1930 AND 1931

Month	Exports				Imports			
	1930		1931		1930		1931	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	82,387	$293,135	41,199	$115,678	201,609	$207,461	97,057	$132,937
February	64,267	217,798	25,703	88,989	114,455	119,717	22,370	26,250
March	117,563	357,896	54,599	144,579	43,622	59,981	70,532	80,686
April	57,419	200,217	40,478	116,564	140,871	178,226	54,717	61,728
May	57,423	198,170	48,028	140 953	94,696	111,998	20,061	22,794
June	82,077	223,639	43,619	107.977	55,356	74,370	32,080	42.955
July	47,082	166,577	29,494	97 995	12,404	20,973	17,445	22 349
August	49,031	167,579	39,517	10,643	35,323	39,029	9,760	13,404
September	46,664	153,384	.....	.....	51,096	59,721	.....	.....
October	62,690	190,305	.....	.....	75,284	84,364	.....	.....
November	50,495	151,555	.....	.....	109,124	125,448	.....	.....
December	38,680	134,260	.....	.....	44,157	59,641	.....	.....
Totals	755,778	$2,454,515	.....	.....	977,997	$1,140,929	.....	.....

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1930 AND 1931 (*in thousands of barrels*)

Month	Production		Stocks End of Month		Month	Production		Stocks End of Month	
	1930	1931	1930	1931		1930	1931	1930	1931
January	10,504	8,129	9,646	10,384	July	15,069	12,246	11,684	10,209
February	10,008	7,473	11,572	11,946	August	15,244	11.664	9,275	8,468
March	13,045	9,586	13,503	13,318	September	14,577	10,414	7,783	6,931
April	15,025	11,540	15,164	13,854	October	13,895	.....	7,266	.....
May	16,607	13,159	14,668	13.087	November	11,639	.....	7,758	.....
June	15,895	12,679	13,452	11,837	December	9,484	.....	8,809	.....



Producing capacity utilized by months, January, 1930, to September, 1931.

Traffic News and Comment

Examiner's Reports

Lime and Limestone.—Examiner C. K. Glover recommends that the Commission give the carriers relief from the long and short-haul clause of the fourth section on lime and ground or pulverized limestone and marl from points in Maryland, West Virginia and Virginia to destinations in Virginia upon the following conditions: That the relief shall not apply to circuituous routes in any instance where rates between the more distant points, constructed on the basis prescribed in North American Cement Corp., v. A. & R., 153 I. C. C. 431 and 163 I. C. C. 701, are less than 80 per cent of the rates which would result from the application of that basis to the distance over such circuitous routes, and that rates to intermediate points shall not exceed rates on the basis prescribed in that case and shall not exceed the lowest combination. F. S. A. No. 14,186.

Sand and Gravel.—A finding of unreasonable rates on sand and gravel from LaGrange and Reading, Mo., to destinations in Illinois on the Chicago and Alton as far north as Cheno, Ill., has been proposed by examiner, Burton Fuller. He recommends that the Commission prescribe rates from LaGrange ranging from $1.01 to $1.39 a net ton, and from Reading ranging from 88 cents to $1.26 a ton. He also proposed the awarding of reparation. This case involves destinations on the Alton beyond those to which the Commission prescribed rates in, Missouri Gravel Co. v. C. B. & Q. et al., 132 I. C. C. 200. I. C. C. Docket No. 24,099, Missouri Gravel Co., v. C. B. & Q. et al.

Rate-Committee Dockets

New England Freight Assn.

Crushed Stone. — To meet motor truck competition the carriers propose to reduce the rate on crushed stone from Kendall Green, Mass., to Boston, Mass., from 70 cents to 60 cents a net ton. Docket No. 23,607.

Feldspar.—Shippers propose a reduction in the rate on ground feldspar[1], from Bedford Hills, N. Y., to Lynn, Mass., from 22 cents to 19½ cents for the reason that the proposed rate is necessary to take care of this traffic. Docket No. 23,601.

Trunk Line Assn.

Feldspar.—A reduction in the rate on ground feldspar, carload minimum weight 50,000 lb., from Trenton, N. J., to Mt. Vernon, N. Y., from 22½ c. to 19 c. is proposed by shippers. Docket No. 27,845.

Ground Limestone. — Shippers are asking for a rate of $1.70 per net ton on ground limestone, carload minimum weight 50,000 lb., from West Athens, N. Y., to Harriman and Arden, N. Y. Docket No. 27,836.

Lime and Limestone.—Carriers propose the establishment of a rate of 16½ c. on building lime, carload minimum weight 30,000 lb., and a rate of 16 c. on agricultural, chemical and land lime, carload minimum weight 30,000 lb., and on unburnt ground or pulverized limestone, carload minimum weight 50,000 lb., from Cavetown-Pinesburg district to Chestnut Ridge stations, Walkton to Kunkletown, Pa., inclusive. Docket No. 27,654, Sup. 1.

Sand.—Carriers propose the establishment of a rate on sand[1], to Bridgeburg, Ont., from Philadelphia, Pa., and Raritan River R. R. points of $3.80 per net ton, and from Cape May, Downer, Glassboro, Grenloch, Williamstown, Williamstown Jct., Cedar Lake, Cedarville, Dividing Creek, Farmingdale, Newport, Pinewald, Quail Run and Toms River, N. J., of $4.20 per net ton. Docket No. 27,596, Sup. 1.

Carriers propose to publish a rate of $1.95 a net ton to apply on sand[1], from Hancock, Great Cacapon, and Berkeley Springs, W. Va., to Powhatan, O. Docket No. 27,682, Sup. 1.

A reduction in the rate on blast, engine, fire, foundry, moulding or silica sand 1, from 15½ c. to 14½ c., from Albany, Crescent, Niskayuna, Aqueduct, West Albany, Karner, Schenectady, Coxsackie, Selkirk, Wemple, Glenmont, and Guilderland Center to Brooklyn stations is proposed by shippers. This rate is comparable with the rate on moulding sand from South Schenectady, Delmar and Troy, N. Y. Docket No. 27,837.

Shippers propose the establishment of a rate of 24½ c. on blast, building, engine, glass, quartz, foundry, silex and silica sand[1], from Pinewald, Quail Run and Toms River, N. J., to Oshawa and Kingston, Ont. The sixth class rate now applies. Docket No. 27,852.

Shippers at points shown in the preceding docket propose a rate of 24½ c. on the same commodity to Pererboro, Ont., in Docket No. 27,583.

A commodity rate of 12 c. on sand[1], and ground flint, carload minimum weight 40,000 lb., from Hancock and Round Top, Md., to Lisbon, O., is proposed by carriers. Docket No. 27,703, Sup. 1.

Sand and Gravel.—To meet motor-truck competition shippers have asked that the rate on common sand and gravel[1], from East Branch and Fish Eddy, N. Y., to Hancock, N. Y., be reduced to 40 c. a net ton, to expire Dec. 31, 1931. Docket No. 27,802.

Slag.—Carriers propose a rate of 80 c. a net ton on slag[1], Catasauqua, Pa., to McKeansburg, Pa. Docket No. 27,670.

Shippers propose the establishment of a rate of $1.10 a net ton on slag[1], from White Haven, Pa., to Mocanaqua, Pa. The present rate is $1.10. Docket No. 27,774.

Stone Dust.—Shippers propose the reduction of the rate on refuse stone dust[1], from Casparis, Pa., to Cumberland, Md., from $1.25 to $1.00 a net ton. Docket No. 27,819.

Central Freight Assn.

Cement.—Revision of the rates on cement, carload minimum weight 50,000 lb., from Kosmosdale, Ky., is proposed by carriers. Proposed rates are: to Lerna, Janesville, Bradbury, Toledo, Jones, Newby, Dieterich, Wheeler and Lis, Ill., 13½ c.; to Falmouth 14 c. and to Mackinaw, Ill., 15½ c. Present rates are: to Lerna, Janesville, Bradbury and Toledo, 13 c.; to Jones, Newby and Falmouth, 14 c.; to Dieterich, 12½ c.; to Wheeler and Lis, 12 c., and to Mackinaw, 13½ c. Docket No. 29,513.

Crushed Stone.—Shippers at Lima, O., propose that the rate on crushed stone[1], to Book, O., via D. T. & I., Glen Jean, N. & W., be reduced from $4.10 to $1.45 a net ton. Docket No. 29,466.

Fluorspar.—Carriers propose to establish on fluorspar in packages or in bulk, carload minimum weight 40,000 lb., to Sault Ste. Marie, Ont., from Evansville, Ind., and points taking same rates a rate of $6.95 and from Owensboro, Ky., a rate of $7.95 a net ton. Present rates are $6.94 and $7.94, respectively. They propose to restrict the application of the rates proposed above; also rates named in Item 2,396 of C.F.A. Tariff 237-J, on fluorspar to Sault Ste. Marie, Ont., from Evansville, Ind., and Owensboro, Ky., as fol-

(*Continued on page 77*)

Fourth-Section Relief

Cement.—F. A. Leland has requested fourth-section relief in connection with the establishment of rates on hydraulic, Portland or natural cement from Linwood, Iowa; Hannibal, Alpha, Carondelet, Prospect Hill, St. Louis, Kansas City and Sugar Creek, Mo.; East St. Louis, Ill.; Bonner Springs and Sunflower, Kans., to points in Missouri. F. S. A. No. 14,520.

F. A. Leland has requested fourth-section relief in connection with the establishment of rates on cement from points in Kansas, Oklahoma and Arkansas, to points in Missouri. F. S. A. No. 14,526. Mr. Leland has also made application for fourth-section relief in connection with the establishment of rates on cement from points in Alabama, Georgia, Kentucky and Tennessee to points in Missouri and Kansas. F. S. A. No. 14,527.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

International Cement Co. Earns 83 Cents a Share

International Cement Corp. reports for the quarter ended September 30, 1931, net income of $531,480 after depreciation, federal taxes, etc., equivalent to 83 cents a share on 636,171 no-par shares of common stock outstanding at end of the period. This compares with $589,718, or 92 cents a share, on 636,124 shares in preceding quarter and $1,395,003, or $2.20 a share, on 633,452 shares in the September quarter of the previous year.

Net income for the nine months ended September 30, 1931, totaled $1,532,107 after charges and taxes, equal to $2.41 a share on 636,171 shares, comparing with $3,446,768, or $5.44 a share, on 633,452 shares in first nine months of 1930.

Consolidated income account for the quarter ended September 30, 1931, compares as follows:

	1931	1930
Gross sales	8,938,636	$9,638,985
Expenses, etc.	6,873,986	6,759,010
Depreciation	1,004,923	880,634
Balance	$1,059,727	$1,999,341
Interest tax, etc.	528,247	604,338
Net income	$ 531,480	$1,395,003

Nine months ended September 30:

	1931	1930
Gross sales	$23,918,685	$25,930,394
Expenses, etc.	18,671,513	18,794,638
Depreciation	2,307,748	2,160,579
Balance	$ 2,939,424	$ 4,975,177
Interest, tax, etc.	1,407,317	1,528,411
Net income	$ 1,532,107	$ 3,446,766

Alpha Shows Loss After Depreciation Write-Off

Report of Alpha Portland Cement Co. for 12 months ended September 30, 1931, shows net loss of $382,975 after depreciation, federal taxes, etc. This compares with a net income of $1,280,017, equal after 7 per cent. preferred dividends, to $1.60 a share on 711,000 no-par common shares in 12 months ended September 30, 1930.

Consolidated income account for 12 months ended September 30, 1931, compares as follows:

	1931	1930
Net sales	$6,610,293	$10,294,030
Oper. expenses	5,732,968	7,706,667
Depreciation	1,393,521	1,383,594
Oper. loss	$516,196	*$1,203,769
Other inc. (net)	160,976	228,372
Loss	$355,220	†$1,432,141
Federal taxes	27,755	152,124
Net loss	$382,975	*$1,280,017
Preferred divs.	140,000	140,000
Common divs.	888,750	1,777,500
Deficit	$1,411,725	$637,483

*Profit. †Income.

Surplus account is as follows: Surplus October 1, 1930, $4,434,296; deduct: Net loss for 12 months ended September 30, 1931, $382,975; preferred dividends $140,000; common dividends $888,750; additional depreciation for year 1928 as adjusted by Treasury Department $32,367; provision for additional federal taxes for prior years $200,000; adjustment of sack inventory to market value at December 31, 1930, $95,658; surplus September 31, 1931, $2,694,546.

Consolidated balance sheet as of September 30, 1931, compares as follows:

ASSETS

	1931	1930
*Property acct.	$20,085,026	$21,495,585
Cash	3,544,381	5,696,939
Ctfs. of dep.	110,000	.....
U. S. Govt. bonds, etc.	2,954,950	1,357,975
Work fds. & adv.	136,246	192,906
Accts. & Notes rec.	969,069	957,331
Inventories	1,876,558	2,236,986
Miscel. invest.	371,458	273,079
Deferred charges	154,222	131,405
Total	$30,201,910	$32,342,206

LIABILITIES

Preferred stock	$2,000,000	$2,000,000
†Common stock	24,134,500	24,134,500
Accounts payable	260,879	324,611
Wages payable	46,859	71,393
Fed. tax res., etc.	112,127	276,820
Dividends payable	177,750	355,500
Ins. & other res.	775,249	745,086
Earned surplus	2,694,546	4,434,296
Total	$30,201,910	$32,342,206

*After depreciation, depletion, etc. †Represented by 711,000 no-par shares.

Los Angeles Aggregates Producer Cuts Capital

Stockholders of Consolidated Rock Products Co. of Los Angeles, one of the country's largest producers of aggregates, have approved plans for the reduction of the stated capital of the company, F. J. Twaits, president, announced. Changes in the balance sheet giving effect to this reduction, and a readjustment of property values were inaugurated as of October 1, and the company will operate the fourth quarter of this year under the new set-up.

As approved by the stockholders the capital will be reduced by the reduction in the stated value of the preferred stock from $7,500,000 to $1,800,000, and in the common stock from $794,910 to $1. Both classes of stock are of no-par value.

Book values of the properties as carried on the books of the company will be reduced to $4,333,290.18, or to such other sum as the board of directors or the executive committee may fix and determine under the readjustment approved by the stockholders. The company originally was capitalized to reflect values established by a nationally recognized firm of engineers and, accordingly, appeared on the company's books as of June 30, last, at $12,692,001.77.

The plan just approved was proposed in order to eliminate excessive charges for depreciation required under the original property values, Mr. Twaits stated, adding that upon revival of construction activity, the new set-up will facilitate a more rapid building of a surplus from which dividends may be paid.

Texas Gulf Earns $2.64 Per Share in 9 Months

Texas Gulf Sulphur Co. reported for the quarter ended September 30, net earnings of $2,315,926, equal to 91 cents a share, compared with a net income of $3,341,753 for the corresponding period of 1930.

Net income for the nine months ended September 30 was $6,704,091, or $2.64 a share, compared with $10,793,799, or $4.25 a share, in the same period last year.

CURRENT DIVIDENDS

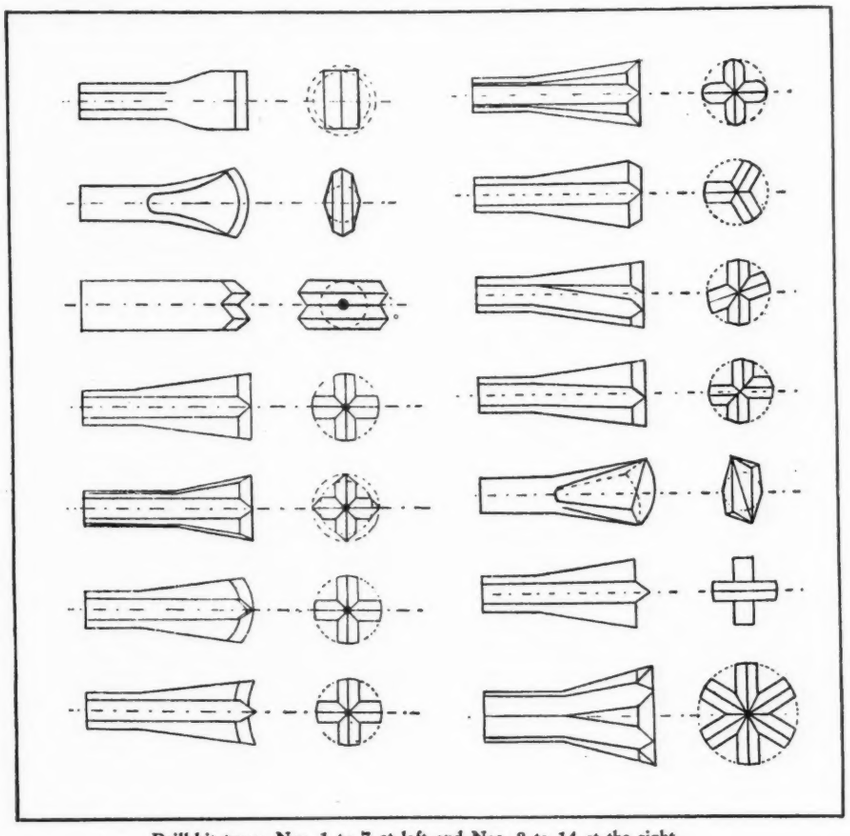
Company	Class of Stock	Dividend Rate	Holders of Record	Payable
Arundel Corp.	Common	$0.75 qr.	Sept. 21	Oct. 1
Boston Sand & Gravel	Common	$0.15 qr.	Sept. 22	Oct. 1
Boston Sand & Gravel	Preferred	$0.87½ qr.	Sept. 22	Oct. 1
Calaveras Cement	Preferred	$1.75 qr.	.....	Oct. 15
Consolidated Oka Sand & Gravel	Preferred	$1.75 qr.	Sept. 25	Oct. 1
Dolese & Shepard	Common	$1.00 qr.	.....	Oct. 1
Dufferin Pav. & Crushed Stone	Preferred	$1.75 qr.	.....	Oct. 1
Ideal Cement	Common	$0.50 qr.	Sept. 15	Oct. 1
International Cement	Common	$1.00 qr.	Sept. 1	Sept. 30
International Salt	Common	$0.75 qr.	Sept. 15	Oct. 1
Johns-Manville	Common	$0.75 qr.	.....	Oct. 15
Johns-Manville	Preferred	$1.75 qr.	.....	Oct. 1
Kelley Island Lime & T.	Common	$0.50 qr.	Sept. 24	Oct. 1
Lehigh Portland Cement	Preferred	$1.75 qr.	Sept. 14	Oct. 1
Missouri Portland Cement	Common	$0.25 qr.	Oct. 22	Oct. 31
National Gypsum Co.	Preferred	$1.75 qr.	Sept. 15	Oct. 1
Newaygo Portland Cement	Preferred	$1.75 qr.	Sept. 25	Sept. 30
Pacific Portland Cement	Preferred	$1.62½ qr.	Sept. 30	Oct. 5
Pennsylvania Glass Sand	Preferred	$1.75 qr.	Sept. 15	Oct. 1
Pittsburgh Plate Glass	Common	$0.50 qr.	Sept. 10	Oct. 1
Port Huron Sulphur	Common	$0.15 qr.	Oct. 15	Nov. 1
Raymond Concrete Pile	Preferred	$0.75 qr.	Oct. 20	Nov. 1
Riversde Cement	1st Pfd.	$1.50 qr.	Oct. 15	Nov. 1
Santa Cruz Portland Cement	Common	$1.00 qr.	.....	Oct. 1
Schumacher Wallboard	Preferred	$0.50 qr.	Nov. 5	Nov. 15
Superior Portland Cement	Class A	$0.27½M	Sept. 23	Oct. 1
U. S. Gypsum	Common	$0.40 qr.	Aug. 15	Sept. 30
U. S. Gypsum	Preferred	$1.75 qr.	Aug. 15	Sept. 30
Warner Co.	Common	$0.25 qr.	Sept. 30	Oct. 15
Warner Co.	1st Pfd.	$1.75 qr.	Sept. 15	Oct. 1
Warner Co.	2nd Pfd.	$1.75 qr.	Sept. 15	Oct. 1

Review of Foreign Practice

Variety of Drill Bits to Meet All Conditions

Drilling capacity depends not alone on the quality of the drill steel and the forging or heat-treatment of the bit, but also on the shape of the bit employed. The best capacity as such is given by the plain straight bit No. 1, in which all of the power is applied at a comparatively small edge. For harder rocks, bits with curved or broken edges are preferred because they keep their edge better. In the plain curved bit No. 2 the air-canal of a hollow drill ends on a side above the edge, avoiding choking of the hole. Nevertheless these simple bits have practical disadvantages. As the bit does not always return to the same groove, the bit wanders, and does not make the perfectly round hole desired for the introduction of the blasting cartridge; also they may leave grooves or edges that may cause the bits to break. The remaining types of bits (Nos. 3 to 14) are modifications to avoid these disadvantages.

No. 3 is a double-edged bit well suited for either hard or soft rock, although not for fissured rock; the angle of the edges can be varied for the hardness of the rock; this bit is well suited to hollow drills, the air canal being located between the two edges. The cross bit No. 4 is good for keeping well-rounded holes; the working edges describe a perfect circle, keeping the hole round and avoiding grooves. No. 5, also a cross bit, differs from No. 4 in the greater angle of the sloping head, the lower edges describing a circle smaller than that of the bit edges, with the disadvantages of increased wear on the bits and less well-rounded holes. No. 6, with a raised center, facilitates the beginning of a bore hole, and is especially recommended for the first inches of drilling. In No. 7 it is the edges which are raised; this bit gives a well-rounded hole and the capacity is good, for the raised edges break off the stone; this bit must be carefully hardened to keep the raised edges from breaking. No. 8 is also a cross bit, with rounded edges, and is suited especially for soft stone such as slate. The Y-bit, No. 9, also gives a well-rounded hole, and the arrangement of the cutting edges leaves ample room for the removal of dust. The X-bit, No. 10, is especially good in deep and wide holes, as it leaves neither grooves nor edges. No. 11 is also an X-bit, somewhat different in form to simplify resharpening. The Z-bit, No. 12, is good in softer stones, but in harder stones the edges wear too fast. No. 13, which is less well known, has two cross-points, one for advancing and one for maintaining rounding; it is used particularly for hard stones and heavy drills. No. 14 is a rosette bit, which can also be made with eight points. Unlike all bits mentioned so far, its action is grinding rather than cutting; it is good for hard stones, and gives a well-rounded hole even at the beginning of the bore-hole.



Drill-bit types, Nos. 1 to 7 at left and Nos. 8 to 14 at the right.

Choice of bits depends of course on practical experience, and a comparison of results from different types of drills will show which is most satisfactory for a particular rock. One method of test is to watch the dust, for in general the drilling capacity increases with the coarseness of the dust.—*Stein-Industrie*, Berlin, 26:259, Sept. 3, 1931.

Phosphoric Admixtures for Sea-Water Concrete

Portland cement is often strongly attacked by sea water, the chlorides in the sea water dissolving the lime from the cement and the sulphates forming lime-alumina-sulphates with a tendency to crumble easily. The more expensive alumina cements can be used for resisting sea water, or the mortar or concrete can be protected by means of sebacic alkalies added to the mixing water, or by bituminous coatings. These methods are not entirely satisfactory, however, for the admixtures densify and retard the percolation of water but are not resistant to salt solutions, while in the other case water gets at the concrete through small cracks which are always present.

A patent recently applied for in Germany (H 121,426) aims to protect against sea water by adding to the cement or to the dry concrete mix either phosphorites or other insoluble or hardly soluble salts of phosphoric acid. The material can be mixed either in the grinding of clinker or in the concrete mixer, as required. A mixing proportion recommended is 70 parts of cement, 30 parts of phosphorite and 300 parts of sand; however, various other proportions are possible. Standard testing specimens made in the above proportion showed high resistance to chemical attack.

The protective action against sea water is perhaps to be explained in that the free lime present in the cement is converted to calcium phosphate, so that the danger of attack from the salt solutions in the sea water is removed. Raw materials for the admixture may be phosphorites and other slightly soluble phosphates which on account of high content of silica, alumina and iron oxide are not suited for fertilizers (low-grade apatite, Texas phosphate, Esthonian phosphate-shale).—*Zement* 20:875, Sept. 24, 1931.

Recent Patents

AMERICAN

Concrete

Concrete-testing apparatus. Orren H. Hansard and Donald D. McGuire, Nashville, Tenn. No. 1,825,954.

Concrete-admixture composition. Claude D. Cory, Seattle, Wash. No. 1,826,166.

Concrete mixer. Samuel Shafer, Jr., Milwaukee, Wis., assignor to Chain Belt Co., same place. No. 1,826,289.

Excavating

Conveyor excavator. Alphonse V. Huennekens, Milwaukee, Wis. No. 1,825,956.

Selective drive for excavating machines. Walter Harnischfeger, Milwaukee, Wis., assignor to Harnischfeger Corp., same place. No. 1,826,466.

Underground Equipment

Mine car. Edgar H. Bostock, Nutley, N. Y. No. 1,825,850.

Mine car. Thomas R. Evans, Petros, Tenn. No. 1,825,943.

Mining apparatus. Charles F. Osgood, Claremont, N. H., assignor to Sullivan Machinery Co., same place. No. 1,826,218.

FOREIGN

Blasting

Blasting cartridges and charges. A. C. Scott and D. Hodges. British 354,305, 354,306 and 354,342.

Cement and Concrete

Manufacture of cement. J. F. Goddard and Super Cement, Ltd. British 354,502.

Process for sintering and calcining cement or like materials. Metallgesellschaft Akt.-Ges. British 355,564.

Process for making cement impervious. H. E. Potts (Chemische Fabrik Grünau Landshoff & Meyer Akt.-Ges.). British 355,583.

Process for accelerating the hardening of mortar, concrete and the like. Albert Brund and Helge Bohlin, Härnösand, Sweden. German 535,243.

Process for drying or thickening of damp or slurry-like material, particularly of cement raw slurry. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 534,777.

Bauxite-cement mortar or bauxite-cement concrete mixture. Ungarische Allgemeine Kohlenbergbau Act.-Ges., Budapest, Hungary. German 535,715.

Process for correcting a cement raw-mix with a natural stone approximating the Portland cement raw mix. Oskar Tetens, Währentrup. German 535,349.

Crushing and Grinding

Single-roll grinding mills. L. G. Holmes and Grinding-Mixing-Separating Engineering Co. Soc. Anon. British 355,248 and 355,249.

Roller grinding mills. Brinjes & Goodwin, Ltd., and C. F. N. Seaman. British 355,511.

Jaw crusher. Karl Zix, Quint b. Trier. German 535,308.

Wind-swept centrifugal grinding-mill with vertical shaft. Adolf Steinbrückner, Duisburg-Wanheimerort. German 535,347.

Sieve ball-mill. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 535,309.

Air-swept impact pulverizer. Deutsche Babcock & Wilcox Dampfkessel-Werke Akt.-Ges., Oberhausen i Rhld. German 535,310.

Process and apparatus for fine grinding, especially of coal. Maurice Madore, Alfort, Seine, France. German 535,311.

Sifter for air-swept impact pulverizer. Paul Anger, Kiel. German 535,348.

Air heater for pulverizers. Foster Wheeler Corp., New York, N. Y. Canadian 316,111.

Drilling

Percussive tools. Aktiebolaget Nordiska Armaturfabrikerna. British 354,648.

Percussive tools. G. H. T. Rayner and P. Rayner. British 354,807.

Rock drills, cutting picks and other hard metal tools. F. Krupp Akt.-Ges. British 355,127.

Feeding devices for percussive tools. Ingersoll-Rand Co. British 355,587.

Centralizer for drill steels. Ingersoll-Rand Co., New York, N. Y. Canadian 316,125.

Drying

Rotary drier for fluid and paste-like materials. Georg Grabowsky, Berlin. German 535,229.

Excavating

Suction-dredge heads. J. Reid. British 355,005.

Gypsum

Process for the production of gypsum from anhydrite. Victor Lefebure, London. German 535,432.

Kilns

Methods of and apparatus for burning slurry-like material. E. Ronne. British 354,565.

Shaft kiln for sintering, roasting and calcining. Vereinigte Stahlwerke Akt.-Ges., Dusseldorf. German 534,963.

Apparatus for burning slurry-like materials, particularly cement slurry. Dr. Nikolaus Polgar, Vienna, Austria. German 534,877 and 534,878.

Apparatus for the exchange of heat between solid to fluid materials and gaseous materials. Arno Andreas, Münster i. W., Germany. German 535,056.

Lime and Magnesia

Process and apparatus for slaking lime or similar dust-raising materials. Stanley Travis, Shipham, Winscombe, England. German 535,604.

Process for producing a heat-insulating material of basic magnesium carbonate and textiles. Lüneburger Isoliermittel und Chemische Fabrik Akt.-Ges., Lüneburg. German 535,448.

Process for manufacturing insulating objects consisting of basic magnesium carbonate. Kali-Chemie Akt.-Ges., Berlin. German 535,244.

Material-Handling

Endless conveyors. L. Granges. British 354,169.

Haulage pulleys for use in collieries, quarries and other places. J. King & Co. (Leeds), Ltd., and J. E. S. King. British 354,348.

Aërial ropeway conveyors. P. Klein. British 354,210.

Endless conveyors. General Electric Co., Ltd., and C. H. Marshall. British 354,519.

Jigging conveyors. C. Schenck Eisengiesserei und Maschinenfabrik Darmstadt Ges. British 354,571.

Dumping-apparatus for cars and the like. H. Lees & Co., Ltd., and A. W. Biles. British 354,580.

Cableway for concrete construction. Adolf Bleichert & Co. Akt.-Ges., Leipzig. German 534,964.

Conveying apparatus. A. T. G. Allgemeine Transportanlagen-Gesellschaft m. b. H., Leipzig. German 534,882.

Apparatus for indicating the filling of bins. Kosmos G. m. b. H. Rud. Pawlikowski Görlitzer Maschinenfabrik, Görlitz. German 535,228.

Mixing

Devices for blending, mixing, agitating and aërating liquids, and kindred uses. W. H. Carter-Lee. British 354,403.

Concrete mixers fitted with weighing devices. T. L. Smith Co. British 354,598.

Concrete mixer. Koehring Co., Milwaukee, Wis. German 535,601.

Automatic control apparatus with mixing-time meter for concrete mixers. Koehring Co., Milwaukee, Wis. German 535,714.

Sacking

Sacks or bags. J. D. Rawlins and Paper Sacks, Ltd. British 354,800.

Screening and Separating

Centrifugal dust-separator. T. Fröhlich Akt.-Ges. British 354,608.

Impact vibrating mechanism for screens. U. S. James. British 354,895.

Apparatus for vibrating screens, shaking tables and other apparatus. General Electric Co., Ltd., and J. W. Sherwen. British 355,309.

PIT AND QUARRY will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.

Manufacturers' Publications

Each publication listed below contains information of interest to nonmetallic mineral producers. Readers may obtain, without charge—except where a price may be stated—and without obligation, copies of any of these publications by writing directly to the manufacturers who publish them. Please mention PIT AND QUARRY *when writing.*

Cars

Industrial Railways. 6 p. (Bull. 102. American Car & Foundry Co., New York, N. Y.) Describes and illustrates the A. C. F. line of industrial railway cars and track. Each type of car and a condensed description is shown.

Crushers

Badger Roller Bearing Crusher. 4 p. (Wisconsin Foundry & Machine Co., Madison, Wis.) Describes and illustrates a new roller-bearing jaw crusher manufactured in sizes from 9 in. by 36 in. to 15 in. by 38 in.

Dust Collectors

Multiclone Dust Collectors. 16 p. (Western Precipitation Co., Los Angeles, Cal.) Describes and illustrates a separator of the centrifugal type in sizes suitable for a wide type of installations. Drawings are used to show the construction while photographs show the application of the collectors in industrial plants.

Gears

Welded Steel Gears. 8 p. (Lukenweld, Inc., Division of Lukens Steel Co., Coatesville, Pa.) Describes and illustrates the making of steel gears from welded blanks produced by this concern.

Generators

Medium-Speed Alternating-Current Generators. 4 p. (Bull. GEA-1483. General Electric Co., Schenectady, N. Y.) Describes and illustrates a line of a-c. generating units for belt drive or direct connection known as Types ATB and ATI. The smaller machine is rated at 12 to 600 kw. (0.8 power-factor) and the larger at 15 to 750 kw. (1.0 power-factor).

Ideal Synchronizing Alternators. 4 p. (Bull. No. 512. The Ideal Electric & Manufacturing Co., Mansfield, O.) Describes and illustrates the details and application of a new synchronizing alternator to twin engines on twin-screw vessels.

Lubrication

"Causes and Treatment of Hot Bearings." 3 p. (*Lubrication* for September-October, 1931. The Texas Co., New York, N. Y.) Describes and illustrates the conditions which cause hot bearings and suggests the proper measures for their correction.

Motors

General Purpose Synchronous Motors. 4 p. (Bull. GEA-246C. General Electric Co., Schenectady, N. Y.) Describes and illustrates synchronous motors of the 7500 Series in 2- or 3-phase windings. The motors are said to maintain the operation characteristics of GE squirrel-cage induction motors with the added efficiency and power-factor advantages of the synchronous types.

Screens

Simplicity Utility Gyrating Screen. 4 p. (Simplicity Engineering Co., Durand, Mich.) Describes and illustrates the new Model B 4-ft. by 8-ft. gyrating screen recently developed by this pioneer manufacturer of gyrating sizing units. Single-, double- and triple-deck models are available in flat-pulley, V-belt or direct-motor drive.

Welding

"A $1,300 Saving." 1 p. (*Oxy-Acetylene Tips* for October, 1931. The Linde Air Products Co., New York, N. Y.) Describes and illustrates how a middle-western stone producer put its hammer-mill back in service in three days by bronze welding after the side frame was broken.

Torchweld Welding and Cutting Equipment. 32 p. (Torchweld Equipment Co., Chicago, Ill.) A pocket-size catalogue describing and illustrating the different styles of welding and cutting torches and its gas-pressure regulators. Line drawings are used to show construction and safety features of the equipment. An interesting item is a new brazing torch for use with natural or artificial gas and oxygen.

Wire Rope

"B & B Ropes at Work in 58-Year-Old Quarry." 2 p. (*The Yellow Strand* for October, 1931. Broderick & Bascom Rope Co., St. Louis, Mo.) Describes and illustrates the plant and quarry of the Illinois Electric Limestone Co. at Fallings Springs, Ill., with particular reference to the part played by wire rope in stripping and loading.

Traffic News

(*Continued from page 73*)

lows: "When in connection with the M. St. P. & S. S. M., will apply only via Manistique, Mich. Docket No. 29,494.

Sand.—Carriers propose to publish a commodity rate of $1.51 on core sand from Juniata, Mich., to Cadillac, Mich. The sixth class rate now applies. Docket No. 29,474.

Sand and Gravel.—Shippers are seeking a reduction in the rate on sand and gravel[1], from Massillon, O., to Norwalk, O., from $1.20 to 95 c. a net ton. Docket No. 29,482.

A reduction in the rate on sand and gravel[1], from Oxford, Mich., to Wiard, Mich., from 85 c. to 78 c. is proposed by carriers. Docket No. 29,490.

Silica.—Carriers propose to reduce the rate on silica, carload minimum weight 40,000 lb., from Cincinnati, O., to Norfolk and Newport News, Va., from 38½ c. per 100 lb. to $5.20 a net ton. Docket No. 29,510.

Western Trunk Line

Cement.—Rates on cement from Chicago, Ill., as described in W.T.L. Tariff 133-G, to the following points in Wyoming are not subject to Jones' Combination Tariff 228. Shippers propose that these rates be made subject to this tariff. Destinations are: Corlett, Borie, Otto, Granite Cannon, Ozone, Buford, Sherman, Dale Creek, Hermosa Colores Red Buttes Satanka, Ferelle, Plaster Spur and Laramie, Wyo. Docket No. 6,819-B.

Crushed Stone.—Shippers propose that Hannibal, Mo., be placed on the same basis as Quincy, Ill., on shipments of crushed stone and related articles, to Oshkosh, Wis., Eau Claire, Wis., and Menominee, Mich., groups, as published in W.T.L. Tariff 6-Q, Item 2,360, namely, 12 cents to Oshkosh and Eau Claire, and 14 c. per 100 bl. to Menominee. Docket No. 6,296-A.

Dolomite.—Shippers propose the establishment of a rate of $1.70 a net ton on burnt or roasted dolomite, carload minimum weight 60,000 lb., from Chicago, Ill., to Milwaukee, Wis., in lieu of the present rate of 14½ c. per 100 lb., carload minimum weight 40,000 lb. Docket No. 1,214-B.

Southwestern Freight Bureau

Amiesite and Asphalt Rock.—Shippers propose the establishment on asphalt rock, natural or coated with not to exceed 5 per cent. of road oil, crushed or ground, and on stone coated with not to exceed 5 per cent. of road oil, crushed or ground, in straight or mixed carloads[1], from Blewett, Cline, Dabney, Smythe and Whitemines, Tex. (and on request from other southwestern producing points), to Chicago, Ill., and intermediate points in Illinois, as covered in second block of Item 1,460 S.W.L. Tariff 20-H, a rate of $5.50 per net ton, and, on request, similar revision from other southwestern producing points, observing I.C.C. 23,094 scale as minima to the respective destinations from such producing points. Texas producers are endeavoring to market their rock in Chicago in competition with Kentucky producers, who now have a rate all-rail from Bowling Green, Ky., of $3.49 per ton and, it is stated, a barge-rail rate of $3.20 per ton. The proposed rate is based on the short line distance from Cline, Tex., to Chicago, Ill., using same formula for applying the rates from the Texas producing group as authorized in I.C.C. Docket No. 23,094. Docket No. 23,564.

[1] The carload minimum weight will be 90 per cent. of the marked capacity of the car, except when car is loaded to full cubical or visible capacity actual weight will apply.

Legal Information for Operators

Court Cites Lien Law in Attempt to Defraud

A majority of state legislatures have enacted laws which protect property owners against sale of their homesteads up to a prescribed valuation. Therefore, a mechanic's lien on a homestead is invalid, unless both the husband and wife have performed some act which indicate their waiver of all mechanic's lien rights.

For instance, in Home *v.* Muhl, 37 S. W. (2d) 316, it was shown that a husband and wife executed a mechanic's-lien contract and note covering certain repairs and improvements to be made. Thereafter these owners made application to a loan company for a loan for the purpose of taking up the mechanic's lien note.

Later litigation developed over the validity of the mechanic's lien. In holding the lien valid, the Court stated the following important law:

"Ordinarily the erection of the improvements as per the terms of the contract is a necessary prerequisite to the creation of a valid mechanic's lien on the homestead, but where the husband and wife have, by their conduct, led an innocent third party to believe that a valid lien has been created on the homestead and such a third party is caused to invest his funds on the faith and credit of such lien, the husband and wife are estopped as to such third party to plead that the lien is invalid. . . . A liberal rule will be employed to protect the homestead from forced sale; but it was never intended by the framers of the Constitution that the homestead law should be used as an instrument to defraud an innocent third party."

License to Manufacture Patent Cement Revoked

Generally speaking, only the owner of a patent and a person holding exclusive rights under the patent may make a valid contract granting rights to others to make, sell and use the patented invention.

For example, in Wyman v. Monolith Portland Cement Co., 44 F. (2d) 328, it was disclosed that a patentee named Wyman entered into a contract which provided for the organization of a corporation to manufacture and market cement under a patented process. It was agreed that the contracting parties would act collectively as trustees of the corporation and decide all questions that might arise. It was further agreed that the owner of the patented process would grant to the corporation the exclusive license to manufacture and sell the cement, with the right to grant licenses to others on royalty basis. Wyman failed to organize the corporation but a partnership was formed. Wyman granted a license to the Monolith Portland Cement Co. to use the patented process. Later litigation developed and the court held the license granted by Wyman to be illegal, saying:

"The appellants are not the owners of the patent in suit and can not maintain a suit for infringement unless they are grantees or assignees of the patent, in whole or in part, or unless they are grantees of an exclusive right under the patent within some specified territory. . . . The owner of the patent expressly agreed to grant to the corporation to be formed an exclusive license to manufacture and sell cement under the letters patent and to grant licenses to others on a royalty basis, but made no grant of any kind to the appellants individually."

River's High-Water Mark Declared Boundary Line

Various courts have held that, where a shore line is a boundary line, the actual line is the high-water mark.

For illustration, in Smoot Sand & Gravel Corp. *v.* Washington Airport, 51 S. Ct. 474, it was disclosed that a property owner in Virginia sued a sand-and-gravel company to prevent it from obtaining gravel between the high- and low-water mark on the Virginia side of the Potomac River. It was contended, since the gravel company's property was located in the District of Columbia and the river being the boundary line, the company should not be permitted to take gravel from the Virginia shore line.

It is interesting to observe that the Supreme Court of the United States held the gravel company entitled to continue taking gravel from the Virginia side, and said:

"It must be assumed that the title of Maryland was that conveyed to Lord Baltimore by the charter of Charles I. and ran to and along the farther bank of the Potomac River. . . . This means that the boundary was the usual high-water mark . . . so that the only question is whether anything has happened since to change the original line."

Marble Worker Awarded Compensation for Injury

It is well settled that before an employee may recover damages from an employer for an injury, alleged to have been sustained in the performance of his regular duties, the employee is obligated to prove that he was injured while working at his regular duties.

For example, in the late case of Sinitiere *v.* Morris, 132 So. 144, it was disclosed that an employee, who was employed in cutting, carving, and polishing marble, alleged he received an injury to his thumb resulting in a temporary total disability.

Since the employee proved by testimony that compensation should be allowed him for the injury, the court held the employer liable, and said:

"We will now state in conclusion that all the evidence in the case, that introduced by the plaintiff (employee) as well as that introduced by defendant (employer), proves beyond question that plaintiff received an accidental injury to his thumb, involving the use of his hand, while working in the employ of the defendant and in the work in which he was engaged to do."

Sand or Cement Carried by Wind Held Nuisance

Generally speaking, a principal contractor is not liable in damages for an injury resulting from negligence of a subcontractor, particularly if the latter has full control over the manner of performing the work. On the other hand, it is important to know that various courts have held that a principal contractor is liable for a nuisance maintained by a subcontractor.

For instance, in the late case of Snow *v.* Marian Realty Co., 299 Pac. 720, it was shown that a principal contractor sublet work to a subcontractor. A property owner filed suit against the principal contractor and the subcontractor, alleging that smoke from the donkey engine and sand and cement from uncovered piles of the subcontractor were carried by the wind to his building, discoloring it, and necessitating repainting it.

It is interesting to observe that the higher court held the principal contractor not liable for negligence of the subcontractor, but held the principal contractor guilty of maintaining a nuisance, although the nuisance was caused by the subcontractor. This court said:

"The evidence hardly supports such a finding. The record shows that the acts complained of were performed by the contractors, over whom the Marian Realty Company exercised no authoritative control; and for the negligence of such independent contractors the company is not liable. . . . Of course, neither the donkey engine nor the piles of sand and cement could be classified as nuisances per se, but the manner in which they were maintained made them such. . . . Nor does it make any difference whether the defendants, as they contend, exercised ordinary care in handling the engine and materials. The injury to the property itself gives rise to the liability, irrespective of care or lack of care. Nor will the adoption of the most approved appliances and methods of production justify the continuance of that which, in spite of them, remains a nuisance."

New Machinery and Supplies

Builds Series of Small Four-Cylinder Engines

The Hercules Motors Corp. of Canton, O., is now manufacturing a line of small, modern four-cylinder engines and power units designated as the Hercules IX Series. Models are available in the following bore, stroke and displacement.

Model	*Size*	*Displacement*
IXA	3″ x 4″	113.1 cu. in.
IXB	3¼″ x 4″	132.7 cu. in.

The engines embody the usual Hercules fundamental characteristics and simplicity of design and construction. They are designed and built for heavy-duty purposes and are arranged to accommodate all modern accessories.

It should be of particular interest that in addition to their heavy-duty character, these small engines have also been developed for very efficient high-speed operation for automotive and marine purposes. Very shortly these models will make their appearance in the marine market, conversions being offered by two very prominent marine-engine builders.

Full information on the Hercules IX Series will be supplied to those interested by the Hercules Motors Corp.

Roller-Bearing Crusher Is Free from Vibration

The newly-announced Badger roller-bearing crusher manufactured by the Wisconsin Foundry & Machine Co., Madison, Wis., is a jaw-type stone crusher capable of increased output through easy, vibrationless operation.

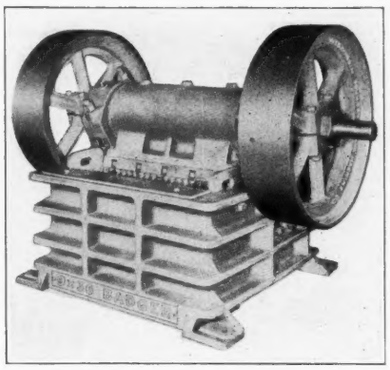
The Badger crusher is especially built for use with portable plants where very hard stone is to be crushed. To meet the requirements of portability and large capacity production with hard stone, the crusher is built with the following features:

The frame is low, deeply ribbed, and thoroughly reinforced, and is capable of withstanding the most severe shocks. The machined frame assures alignment of parts and the uniform distribution of strains to all parts of the frame.

The shaft is extra large in diameter and made of high-grade heat-treated alloy steel. It revolves on proportionately large Timken roller bearings and carries the pitman. The movable jaw is locked by a steel wedge which is bolted to the pitman.

The outer roller bearings on the shaft are set in machined boxes which are split and bolted to frame. This makes the bearings accessible for inspection and facilitates field repairs.

Piston-ring seals enclose the bearings and entirely prevent dust from entering. All adjusting mechanism and the toggle plates for controlling the



The new roller-bearing jaw crusher.

movement of the pitman have machine-finished surfaces assuring ease of movement and even wear. The movable wearing surfaces for the toggle plates are also provided with renewable bushings.

The manufacturer claims the crusher can be run on low power due to the large fly wheels, extra-large roller bearings and the machined surfaces of the crusher. The entire design of the Badger crusher is such as to produce a minimum oversize of material and give a large production capacity.

High-Speed Gear Units Ideal for Pump Service

Standard industrial gear units are designed for use with electric motors running at a maximum speed of 1800 r.p.m., and they are suitable for reducing speed but not for increasing speed, and for tooth velocities not exceeding 2,000 ft. per min.

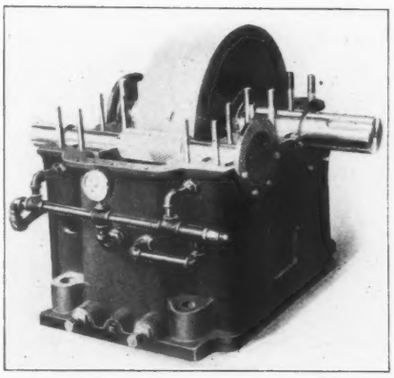
When a gear unit is required for connection to a steam turbine or for any other purpose where the speed of the pinion shaft is over 1,800 r.p.m. it has been considered special. Now, however, the Farrel-Birmingham Company, Inc., Buffalo, N. Y., has developed and standardized a series of gear units suitable for speeds up to 6,000 r.p.m. and powers from 120 h.p. to 2,500 h.p., with ratios up to 10 to 1 for either increasing or reducing speed.

The accompanying picture illustrates one of these gear units with the cover removed to show the gears, which are the Farrel-Sykes herringbone continuous-tooth type. A complete lubrication system is provided, together with an oil cooler consisting of a coil of copper pipe placed in the bottom of the gear case. The inlet and outlet pipes can be seen in the illustrations.

This new series of gear units is especially adapted for connecting Diesel or gas engines to centrifugal pumps. The latter are designed to operate at speeds ranging from 1,200 r.p.m. to 3,600 r.p.m. and the larger engines usually operate at speeds from 225 r.p.m. to 600 r.p.m.

The proportions of the gears, as regards number of teeth, pitch, face widths, diameters, depth of tooth, helical angle, proportions of addendum of pinion to addendum of wheel, are chosen on a scientific basis and with special consideration as to whether the gears are to be used for increasing speed or decreasing speed.

It is now known by students of the subject that gears should be differently proportioned when used for increasing speed than when used for decreasing speed. The new units when made for increasing speed have pinions with numbers of teeth from 27 to 40. When decreasing speed the numbers of teeth in pinions may be as low as 19 without affecting the mechanical efficiency. The use of large numbers of teeth in pinions used for increasing speed permits the desirable feature of long addendums for the



Open view of the high-speed gear unit.

wheels and relatively short addendums for pinions. This provides a short arc of approach and a long arc of recess which increases the mechanical efficiency and durability.

The gear housing, together with the bearings and lubricating system, are all as important as the gears themselves. It is now well known that a high-speed gear unit can not have a high mechanical efficiency if the gears are allowed to run in a bath of oil, because the churning of the oil absorbs power and, therefore, under such a condition high mechanical efficiency cannot be obtained. The unit we use is provided with forced lubrication for all bearings and spray lubrication for the gear teeth. The gears are not allowed to run in a bath of oil and, consequently, the excessive generation of heat is avoided. A small amount of power is necessary to drive the gear pump, but the amount is much less than the amount which would be absorbed by the action of churning oil.

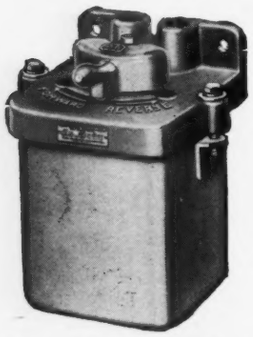
As can be seen from the illustration, the gear unit is self-contained, having its own lubricating pump, oil tank,

cooler where necessary, lubricating fittings consisting of a pressure gauge and a relief valve. The oil pressure should be between 10 and 15 lb. per sq. in. There is no advantage in high oil pressures and the pressure gauge is merely to indicate that there is enough pressure to provide a sufficient volume of oil. So-called forced lubricated bearings are really flood lubricated bearings. All that is necessary and all that can be satisfactorily accomplished is to supply a suitable volume of oil to the bearings. The relief valve on the unit is set to give the correct volume of oil before it leaves the factory and it should not be closed to get a higher pressure.

Drum-Reverse Switch Is of Splash-Proof Design

The Bulletin 350WP splash-proof a-c. and d-c. drum reverse switch has recently been developed by the Allen-Bradley Co., Milwaukee, Wis., for us where an open-type switch is undesirable. Heavy felt gaskets exclude all dust and moisture. The contacts are oil-immersed.

This reversing switch will handle motor currents, directly, at the following ratings: alternating current, 3 hp., 110 volts, 5 hp., 220 volts, and 7½ hp., 440-550 volts; direct current, 1 hp., 115-230 volts. It is provided with six fingers, and may be wired for use with limit switches.



Drum-reverse switch of splash-proof construction.

The top casting, oil tank, hand lever, and holding lugs are cadmium plated to resist rusting and corrosion. The top casting is threaded to receive standard conduit. The oil tank is readily removable for wiring or inspection of the switch. The contact fingers are positively non-stubbing and self-aligning, and are easily adjusted for wear, and the drum cylinder sections are renewable. The hand lever can be furnished with spring return.

Unit Cast-Steel Design in New Model Excavator

Link-Belt Co., Chicago, Ill., has just announced the addition of a new shovel-crane-dragline, known as the K-48, to its line which ranges from ¾- to 2½-cu. yd. capacity.

The Link-Belt K-48 is an all purpose unit serving as a shovel, a crane, a trench hoe or a drag-line. It can be furnished with any or all of the attachments which are usually only available on smaller machines. The K-48 is arranged for gasoline engine, Diesel engine, or electric-motor drive. The gasoline engine has a heavy-duty 130 hp. rating and the Diesel engine or electric motor is of corresponding capacity. As a shovel, it is equipped with a 25 ft. boom, 17 ft. 6 in. dipper stick, and a 1¾-cu. yd. dipper.

The K-48 shovel in operation.

As a crane the K-48 has unusually large rated lifting capacities. It has a rated capacity of 32 tons at 12 ft. 0 in. radius and 10,400 lb. at 45-ft. radius on a 45-ft. boom, and corresponding capacities at other radii and for other boom lengths.

As a drag-line, it will handle a 1¾ cu. yd. heavy or 2 cu. yd. light-medium bucket on a 45 ft. boom, and a 1½ cu. yd. heavy or 1¾ cu. yd. light-medium bucket on a 50 ft. boom, with the boom at any angle convenient for dragline work. It is necessary to work with a "high" boom or at limited radius to handle these loads, as these are conservative ratings which the machine will easily and safely handle.

As a trench hoe, the character of the work and the digging depth determine the size of the bucket used. For normal digging depth, in average soils, a 2-cu. yd. solid-bottom bucket is standard.

Its unusual ease of convertibility is a feature because it reduces the owner's investment in equipment to a minimum, without limiting the range of work possible, and enables him to use this machine to the best and fullest advantage.

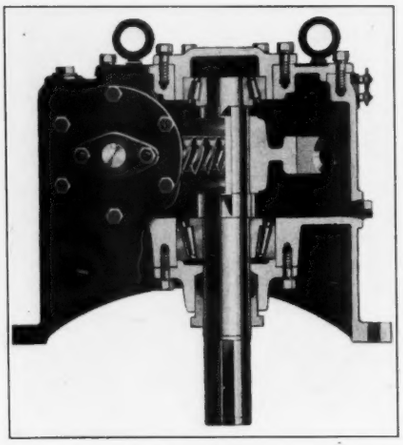
Other features include large, slow-wearing crawler rollers; self-cleaning crawler treads; large ring gear and roller path; unit-cast-steel construction throughout; and large drums, clutches and brakes.

Markets Complete Line of Worm-Gear Reducers

The Palmer-Bee Co. of Detroit, Mich., whose herringbone-gear speed-reducers are well and favorably known in the pit-and-quarry industries, is now marketing with considerable success a line of high efficiency worm-gear reducers.

The design of the Palmer-Bee machines has as its foundation the idea that mechanically-correct contact and perfect lubrication are the real essential requirements for high-grade worm gearing. To secure such contact and lubrication, it is necessary to produce a specific thread contour on the worm and a specific reverse contour on the wheel teeth. Both contours must be developed from the same basic curve.

Mathematical calculations show that the basic curve is neither a straight line nor an involute. Ordinary worms have straight-sided teeth. Ordinary worm wheels have involute teeth. Neither the worm nor the worm wheel has the correct form.



The vertical model worm-gear speed-reducer.

Mathematical calculations definitely indicate the correct basic curve. This curve is different for each individual gear set. Palmer-Bee worm gearing has as its foundation the proper application of true basic curves which are scientifically selected to best meet the requirements for individual worm and worm wheel combinations.

The basic curve is applied to the cutting edges of a milling cutter by the generating process. This cutter is used, in turn, to produce the hob or cutting tool for worm wheels. After milling, the basic hob is machine relieved and tapered before it is finished to become a production tool.

The worm is milled integral with the high-speed shaft on a special worm-thread milling machine employing the cutter described above. A uniform allowance is left for later grinding. Shaft ends are then finish machines. Worm threads and shaft-bearing surfaces are carbonized, double heat treated, ground and polished. The worm is then run with a master worm wheel to test profile bearing contact.

The worm wheel is generated on a special worm-wheel generating machine employing the tapered hob described above. Cutting edges are fed tangentially across the gear blank in such a manner that hob motion assimilates the action of a worm engaging with a worm wheel. The tapered hob first roughs out the tooth spaces. As

work progresses, finer and finer cuts are made. The final cut is essentially a burnishing operation.

Tangential feed hobbing is a true generating process because the hob assimilates the action of a worm as the blank is cut. It is possible to generate worm wheels by this method employing a parallel-type hob. The taper hob has the advantage, however, that rough work is done by roughing teeth while the finest edge of tool is reserved for burnishing only.

Because a worm wheel is generated by the tangential feed method does not mean that the tooth form is ideal. This manufacturing method, while it has many commendable advantages, is simply a means to an end.

In Palmer-Bee improved type worm gearing the worm-wheel teeth envelop the engaging worm threads. The tooth contour is the reverse of the thread contour. Converging nature of surfaces is such to produce a very marked "oil wedge" effect as well as wide bands of contact. In action, Palmer-Bee worm gearing builds up a maximum oil film and power is transmitted through wide continuous bands of oil film.

The speed-reducers are built in standard, inverted and vertical types. They are rated mechanically and thermally in a complete range capable of any type of duty in industrial power transmission.

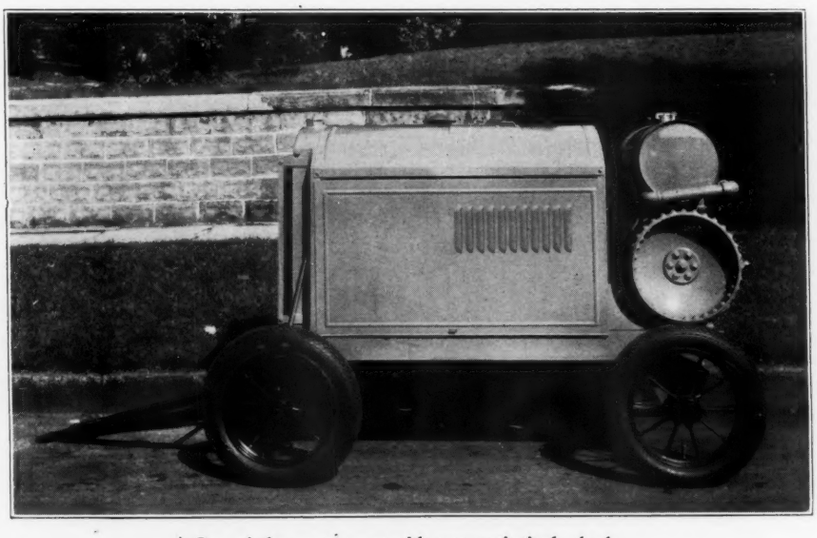
Pneumatic Tires Used on Portable Air-Compressor

One of the most significant recent developments in the portable-air-compressor field is the announcement by the Davey Compressor Co., Kent, O., of the mounting of the machines on pneumatic tires. To those who have had experience with pneumatic tires on equipment of like nature the advantages of pneumatic tires over solid tires are well known.

In the case of portable air-compressors, actual tests conducted at the Davey factory in advance of their adoption as optional equipment proved that with pneumatic tires it becomes entirely feasible to tow a 160 cu. ft. trailer mounted portable air compressor behind a motor truck at speeds of 25 miles per hour. Whereas with solid tires on any portable compressor speeds above ten miles per hour were simply out of the question, because of excessive vibration resulting in serious damage to engine and compressor.

From the purely practical standpoint, pneumatic tires provide all of the advantages to be had from spring-mounted compressor trailers and at considerably lower initial cost.

Effective immediately, pneumatic tires will be provided as optional equipment on Davey air-cooled trailer-mounted air-compressors of all sizes from 110 to 320 cu. ft. capacity.



One of the compressors with pneumatic-tired wheels.

The hoisted body in position to pour concrete.

New Jackass Hoist for Mixed-Concrete Trucks

A new hoist for truck mixers, called the Jackass, has been developed by the Chain Belt Co. for its line of Rex moto-mixers and moto-agitators.

The new hoist arrangement raises the mixer 8 ft. from the ground for a greater delivery and spouting range. The hoist was developed with the co-operation of the Heil Co. of Milwaukee, manufacturer of the Heil hoist. It is a hydraulic hoist fitted to the rear end of the truck chassis and raises the discharge end of the mixer just as a jackass raises his heels to kick. The Heil hoist used has been especially designed for this mixing unit. The lifting effort is exerted directly against the load to raise the drum the desired height. The cost of the concrete in the forms is often cut from 25 to 50 per cent.

From the height of 8 ft. the concrete can be spouted over an area approximately 75 per cent. greater than heretofore. Sidewalks can be poured across parkways without wheeling. Building foundations and walls can be chuted even when the truck cannot get within ten to twenty feet of the hole. Alleys and streets can be fanned their full width. The hoist raises the drum high enough to discharge into a three-yard hopper. The flow of concrete can be regulated easily by the operator from a slow trickle to a full discharge by a simple turn of a handwheel. Though the mixer is raised at a considerable angle, the drum empties itself cleanly and thoroughly.

Chicago Pneumatic Tool Moves Seattle Offices

The Chicago Pneumatic Tool Co. announces the removal of its office and service station at Seattle, Wash., from 1743 First Avenue South to 3201 First Avenue South and the appointment of C. Kirk Hillman as district manager. The new quarters are larger and permit carrying a complete stock of repair parts as well as representative items of the company's various products, which include air compressors, pneumatic tools, rock drills, electric tools, Diesel engines, etc.

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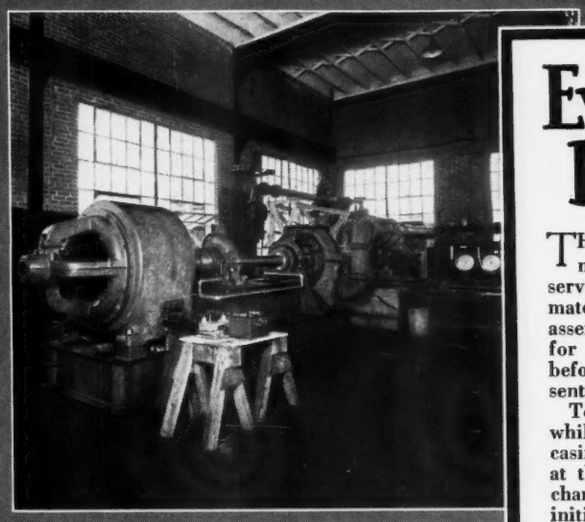

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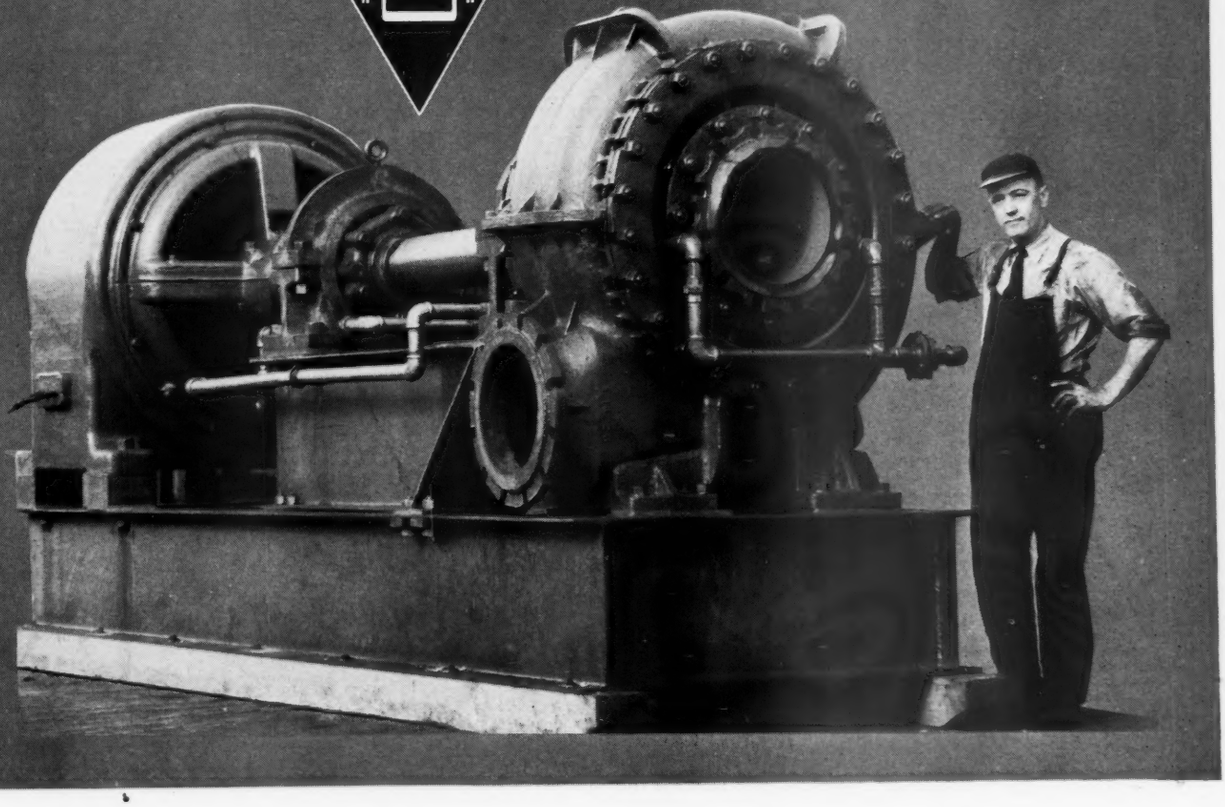
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